Heating Piping & Air Conditioning

SEPTEMBER 1959

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. . . for Consulting Engineers • Mechanical (Heating, Piping, and Air Conditioning) Contractors • Engineers with Plants and Big Buildings

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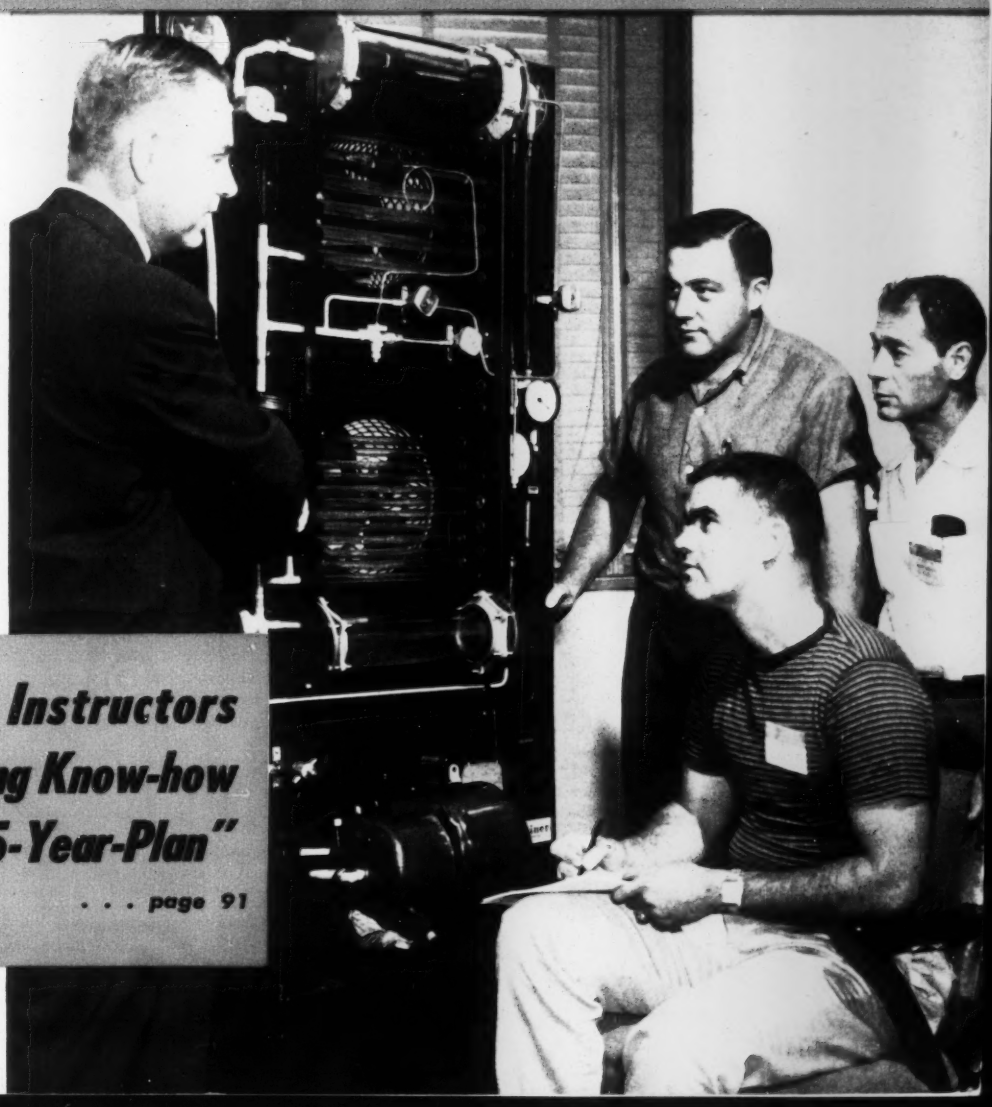

Pipefitter Instructors Gain Teaching Know-how Via UA's "5-Year-Plan"

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Grinnell offers you a complete line of pipe hangers and supports

HERE ARE 24 TYPICAL EXAMPLES . . .

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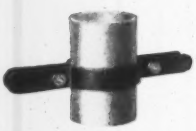
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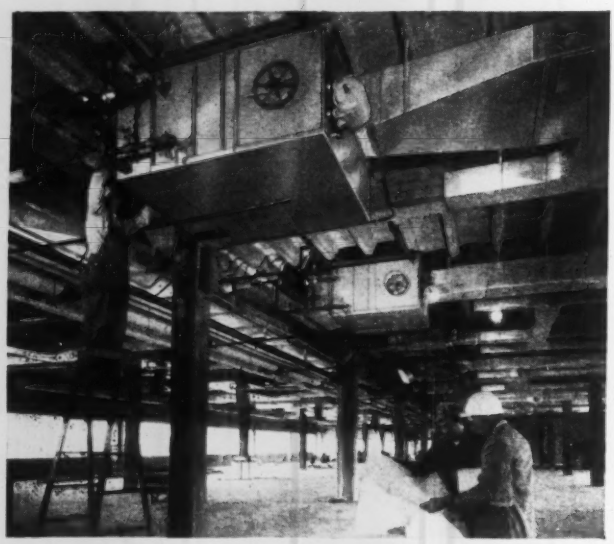

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September 1959

(With which is merged the Aerologist)

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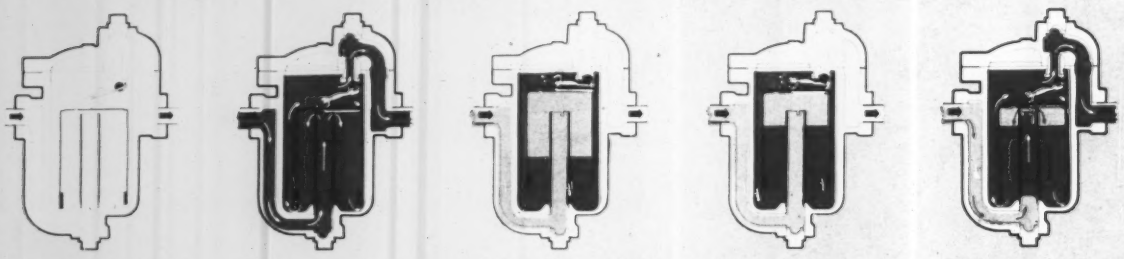
This simple trap operating principle provides the efficiency, dependability and freedom from maintenance necessary for the most profitable use of steam



When trap is first installed, the inverted bucket is down and the valve is wide open.

When steam is turned on, condensate (solid color) flows into trap and out through discharge orifice, until —

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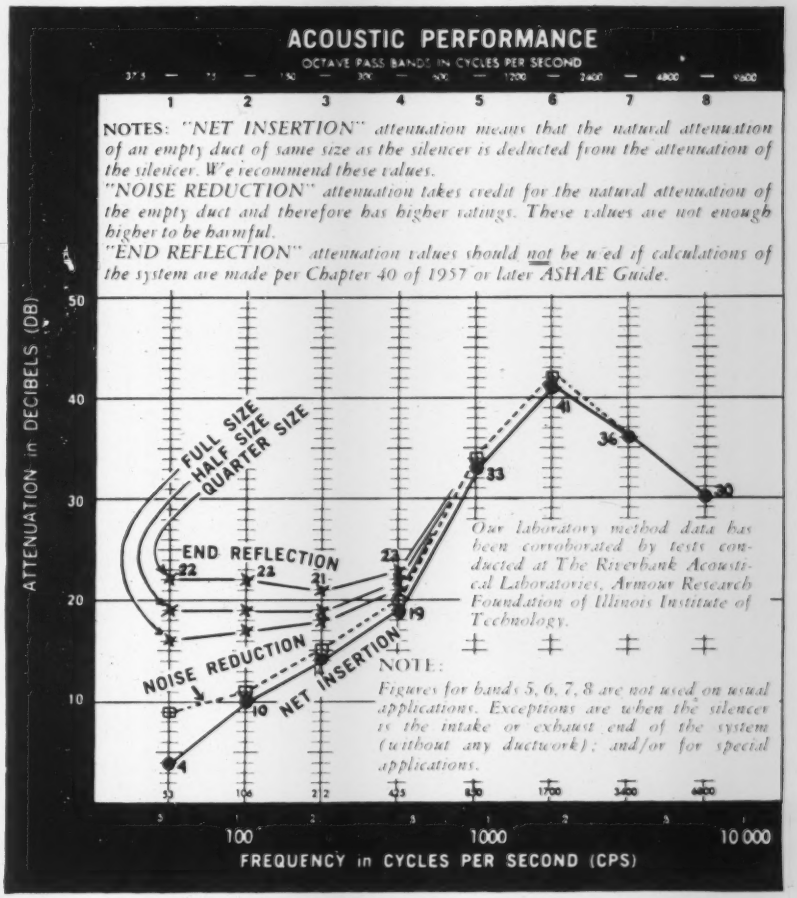
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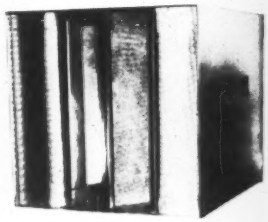

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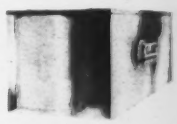

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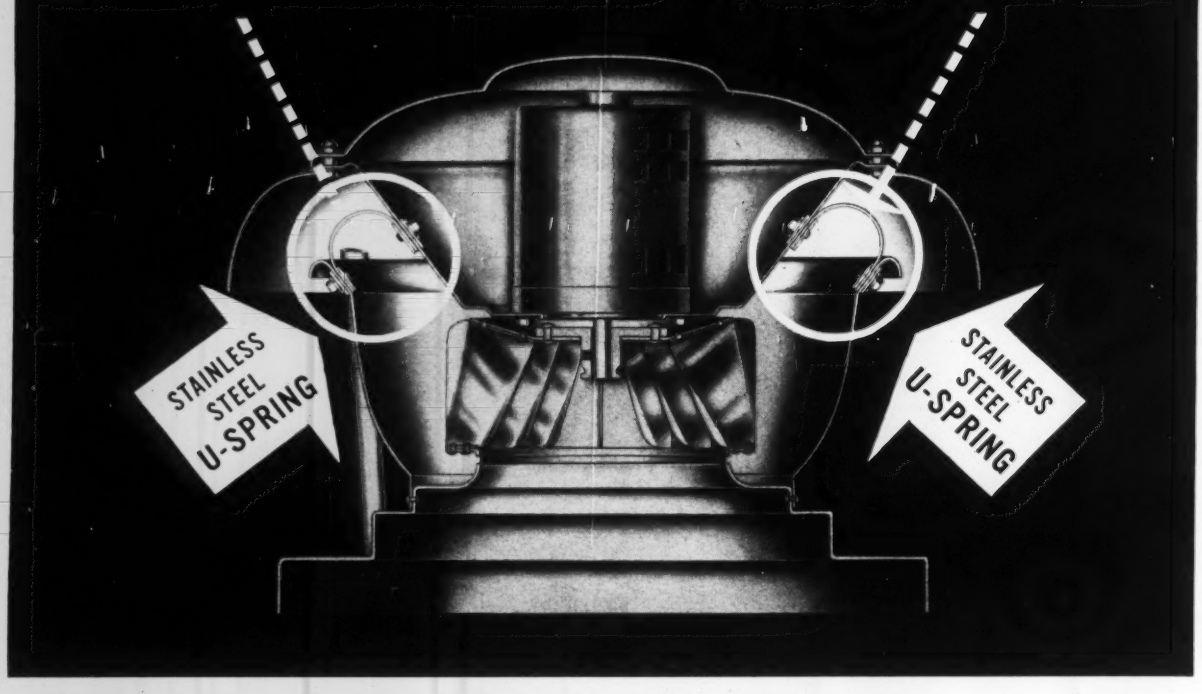

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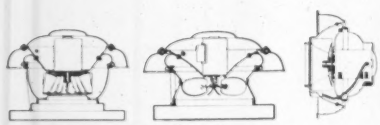

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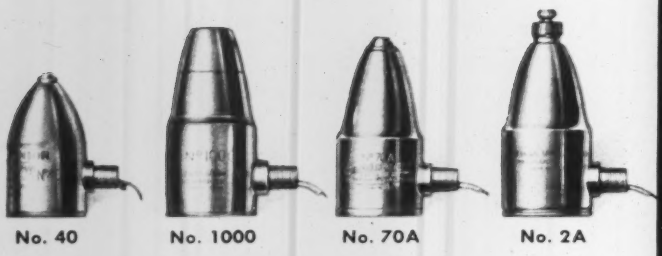

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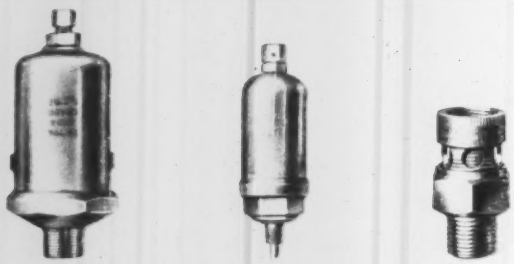

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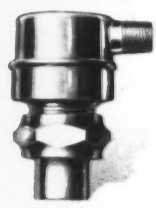

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LETTER FROM THE EDITOR

September 1959

Dear Reader:

One of the highlights of the sixth annual pipefitter apprentice contest and instructor training course, held at Purdue University and sponsored by the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry, was the initiation of a five-year curriculum for apprentice instructors. According to Peter T. Schoemann, UA general president, this program will go a long way toward providing the necessary qualified instructors for the skilled labor force in this vital segment of the heating, piping, and air conditioning industry. A report of this year's instructor training session is on pages 91 to 93. For a report of the apprentice contest, see pages 49 and 50.

Many methods for controlling odors are discussed by Warren Viessman in his article on pages 94 to 99. He points out that in order to eliminate or abate odors in an air conditioned space it is necessary to either remove the offending gases or vapors or reduce their concentration. Odors are affected by temperature and humidity, and some of the physical methods for removal are by ventilation with outside air, air washing or scrubbing, charcoal adsorption, and masking. Other means include chemical destruction of odor sources, vapor neutralization, and catalytic combustion. Of course the quantity of outside ventilation air admitted should be in accordance with engineering requirements and local codes. Mr. Viessman presents an example of possible economies and comparative investment and operating costs of an outside air system and a recirculating air system.

Highlights of the golden anniversary meeting of the National District Heating Association are in the report by John F. Collins, Jr. on pages 100 and 101.

Designing heating and air conditioning systems to provide comfort for combat jet crews involves many special problems which are discussed by Amos B. Hartley on pages 102 to 105. To permit survival at extreme altitudes and temperatures (ranging from 100 F down to -125 F), these facilities are integrated as a basic component of the Boeing B-52G missile platform bomber. The system uses bleed air from the plane's engine compressors for heating and cooling. Air cycle cooling was selected as being the most efficient way to make use of this bleed air. Cabin heating is controlled by a unique electronic temperature regulating system. Due to the extremes in altitude -- often reached in a matter of seconds -- cabin pressurization is a primary consideration.

Calculating piping flexibility by various methods is always a subject of great interest to the engineer involved in the design of these systems. In the past year or so, two comprehensive methods for calculating piping stresses have been presented in these pages. One method was presented by K. Hao Hsiao and a different one was advocated by Edwin A. Wert. Mr. Hsiao checked both methods against each other and presents the calculations on pages 106 to 109 which show the data obtained from the two procedures to be in very close agreement.

Providing environmental control for the occupants of space vehicles will be studied in the new Air Force space cabin laboratory as discussed by L. N. Becklund on pages 110 through 113. Space travel will be simulated to gather information on human psychological and physiological reactions to prolonged flight conditions. The temperature-humidity aspects of this operation and the cabin's gaseous composition control were prime considerations in the design of this chamber. Undoubtedly the data gained from these tests will furnish significant criteria for the design of environmental control systems for tomorrow's space ships.

Cooling electronic data processing equipment is discussed on pages 118 to 120 by Richard Goes. He points out that these systems should be designed for closely controlled temperature and humidity limits, reliability, proper air distribution, minimum outside air, and other factors such as filtering the air, and a well constructed enclosure. He says the more the engineer considers the maintenance man's problems during the design of these systems, the more reliable systems he will design.

To pump solids through a pipeline successfully, several factors should be considered in addition to the economics involved before the pipeline is designed. Julian Nardi gives about 30 such items to consider in his article on page 121. The successful operation of a pipeline for transporting solids requires considerable technical skill, especially at the start, but instrumentation can be used to aid in the proper operation. He suggests that partial processing of a solid while in transit in a pipeline might be the key to a whole new line of products which could be economically pumped through pipelines.

Tests have proved the effectiveness of viscous impingement disposable filtering material in the General Electric Co., Evendale, Ohio, plant to meet their industrial air filtering requirements. C. F. Mowery describes what was done in his article on pages 122 and 123. Installed at a cost saving of $50,000 and at an estimated annual operating cost saving of about $20,000, the results have been very satisfactory. This arrangement, of course, may not be practical for all plants. However, it does show the value of investigating other methods and testing them in actual plant operating conditions.

Modernization of the Hurt office building in Atlanta with a high velocity, high pressure induction air conditioning system is discussed by Ronald L. Moore in his article on pages 127 to 130. Installation of this system was made for only $3.20 per sq ft, or $991 per ton of cooling capacity. The operating cost for the first full summer was just 9 cents per sq ft.

The recent Air Force air conditioning conference stressed the need for considering proper operation and maintenance during every stage of the system design. The HPAC Engineering Data File this month (pages 131 to 146) is our report of this conference. While much of the information is based upon Air Force experience, it applies equally to any air conditioning plant. To insure satisfactory operation, operating personnel must have knowledge of the designer's concept of how the system is to perform and this can and should be provided in the form of operating instructions and operation and maintenance manuals. These will help to maintain continuity of operation and will simplify trouble shooting service when it is needed. Also, it was pointed out at this conference that a preventive maintenance program tailored to meet the system needs will aid considerably in continuous satisfactory performance of the system. A good program will include efficient scheduling of maintenance, collection of records, training of personnel in the necessary skills, and careful and thorough inspection procedures.

Several answers to the question, "Will Redesigned Steam Header Using Same Welding Cap Be Safe?" are on pages 82 and 84. Graphitization of the steel pipe may be a problem with temperatures around 800 F, especially with long durations of service. It is also pointed out in these answers that the welds must be properly made for this to be satisfactory.

The You'll Want to Know news reports are on pages 49 to 54 this month, and "Open for Discussion" is on pages 77 to 80. The HPAC Data Sheet (pages 125 and 126) contains more steam pipe sizing data and this concludes the series, the first of which was presented in the June issue. The Law and Your Profits is on page 124 this month.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

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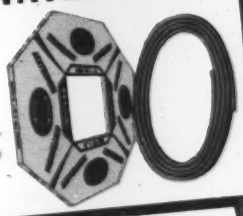

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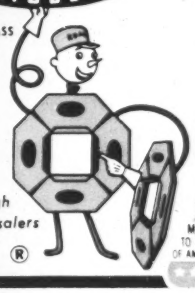

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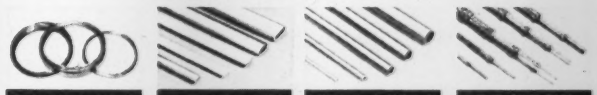

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"WE REDUCED INSTALLATION TIME 25%

with PITTSBURGH FIBER GLASS PIPE INSULATION"

says Mr. Charles W. Smith, President
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Pittsburgh Fiber Glass Pipe Insulation is easily slipped on the pipe. Insulation will be hand-stapled in place, eliminating metal strap fasteners.

"We installed 4,800 ft. of Pittsburgh Fiber Glass Pipe Insulation at Our Lady of Fatima School in Baltimore on water, steam and dual-temperature pipes. The handling ease and application speed of this product, compared with the insulation material previously used, saved us 25% in installation time costs.

"The three-foot lengths are easily spread by hand at the seam and are slipped quickly and snugly over the pipe. Hand stapling eliminated the need for metal strap fasteners. For special lengths, the insulation was easily cut with a knife. Wastage was negligible. Cut ends retained their shape with no fluffing. Short left-over pieces were used on fittings.

"The factory-applied vapor barrier eliminates condensation, which reduces future maintenance costs. Outside jackets present a good appearance and can be painted to match room decorations."

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You can order Pittsburgh Fiber Glass Pipe Insulation in a variety of thicknesses and jackets to your own specifications. For complete information, call your nearest PPG Sales Office, or write to *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Penna.*

PITTSBURGH PIPE INSULATION IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

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Low Water Cut-offs on Hot Water Boilers?!

...the industry has given the answer

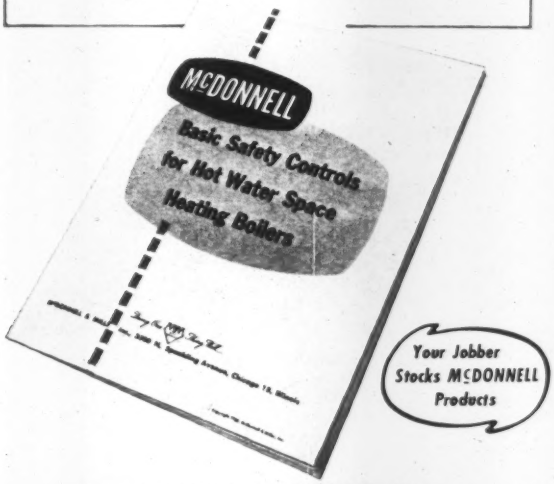
Yes, the answer has come from the field . . . from the engineers, contractors and manufacturers. They have seen the logic of installing a water level control on hot water space heating boilers . . . a low water cut-off, or—for even greater precaution—a feeder cut-off combination.

We knew it was a good idea. Expected it to grow and grow. But frankly we have been surprised at how rapidly the heating industry has taken hold of water level control as a logical team mate for an ASME pressure relief valve.

In fact, many local codes now require a low water cut-off, or feeder cut-off combination, on hot water boilers installed in places of public occupancy—including multiple dwelling units.

Notice the diagrams of recommended installations opposite. For more detailed discussion get this booklet that tells the whole story: "Basic Safety Controls for Hot Water Space Heating Boilers."

The What-Why-How in eight interesting pages
Write for Bulletin P-30C



Your Jobber Stocks McDONNELL Products

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Doing One Thing Well

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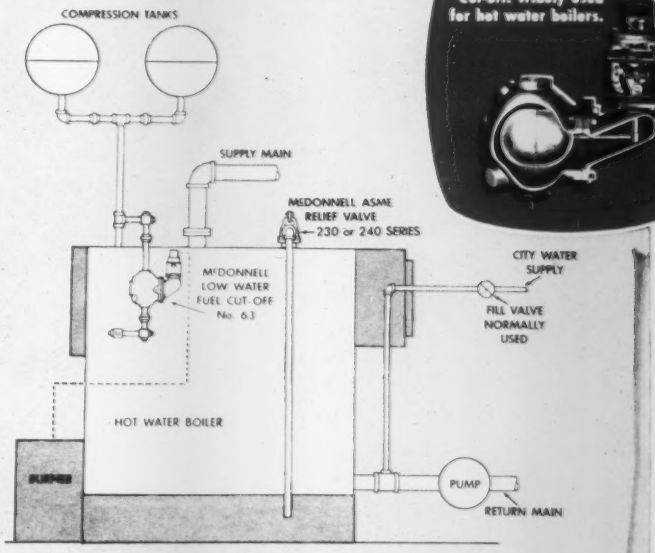
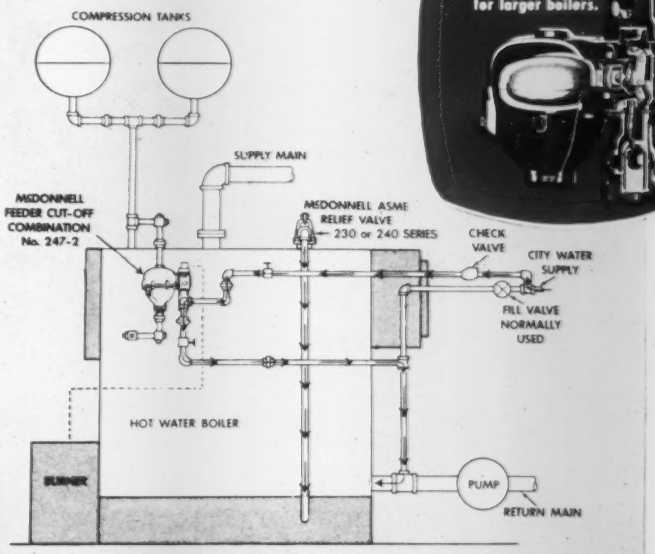
Boiler Water Level Controls

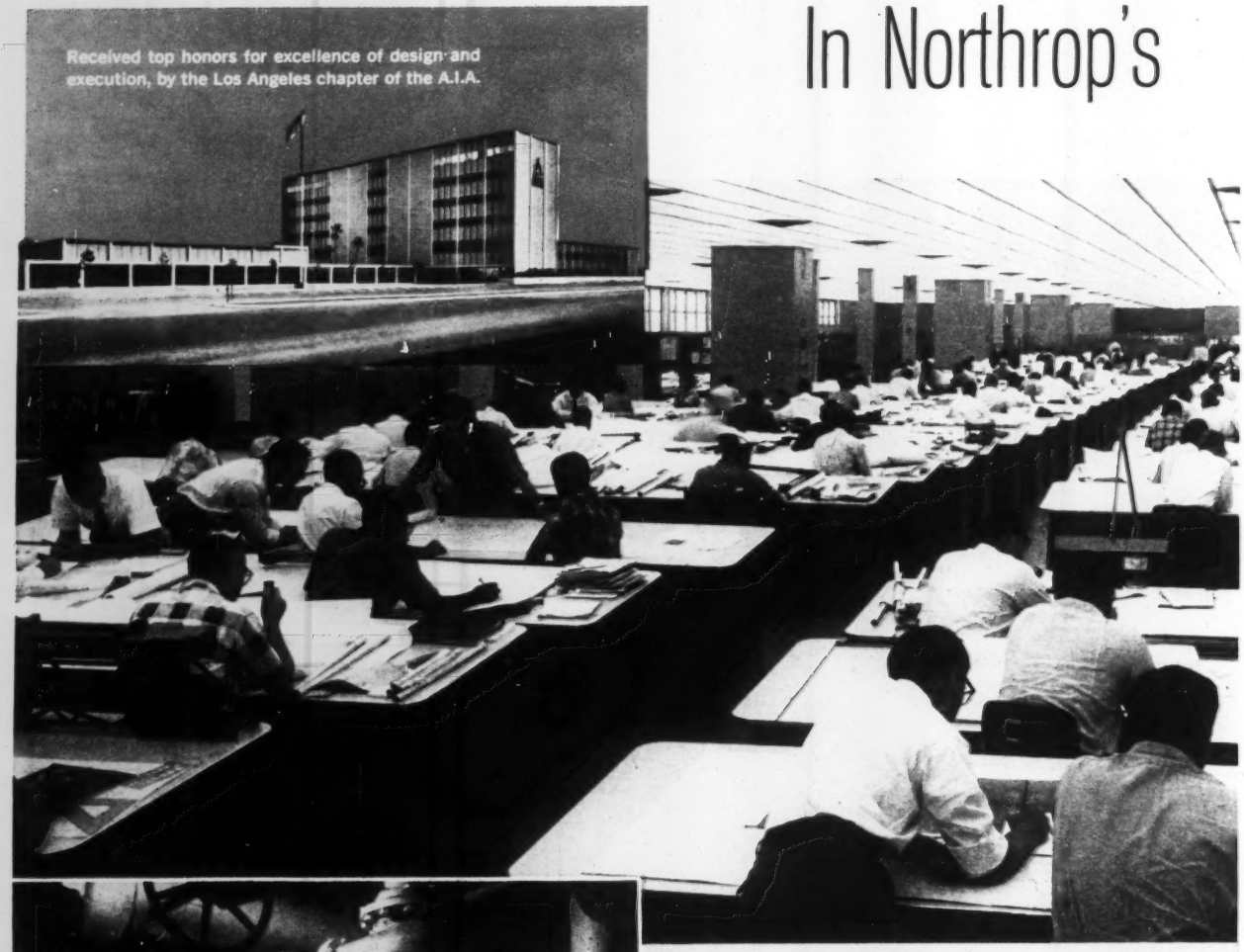


1 The essential low water control for a hot water boiler. A McDonnell Low Water Cut-off located above lowest permissable water level; also McDonnell A.S.M.E. Pressure Relief Valve.



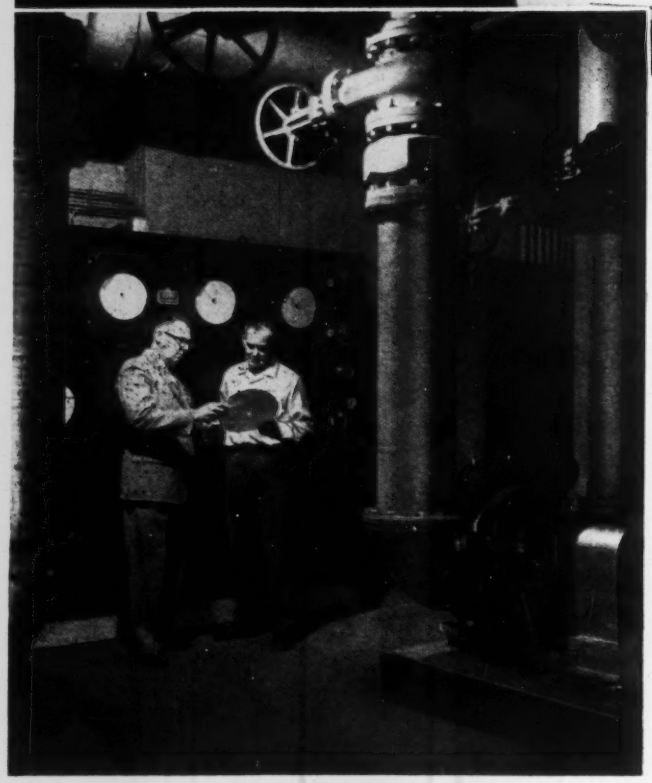
2 The safest and most complete control for a hot water boiler. Offers a combination of mechanical and electrical safeguards which is today's best and most complete answer. A McDonnell combination Boiler Water Feeder and Low Water Cut-off; also McDonnell A.S.M.E. Pressure Relief Valve.

In Northrop's



NORTHROP CORPORATION, SCIENCE RESEARCH CENTER, HAWTHORNE, CALIF.

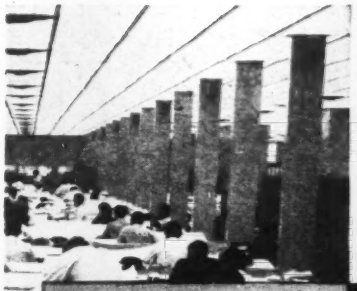
Architects and Engineers:	PEREIRA & LUCKMAN, Los Angeles
Mech. Contractor:	SCOTT CO.
Air Conditioning Contr.:	F. B. GARDNER CO., INC.



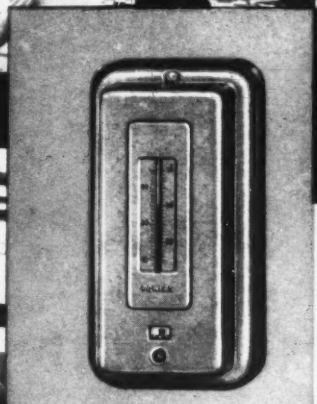
LEFT: Powers Central Control Panel includes recording, controlling, and indicating instruments, for regulating 28 supply fan systems and two 400 ton centrifugal refrigeration compressors.

Partial view of Computer and Datamation Center.

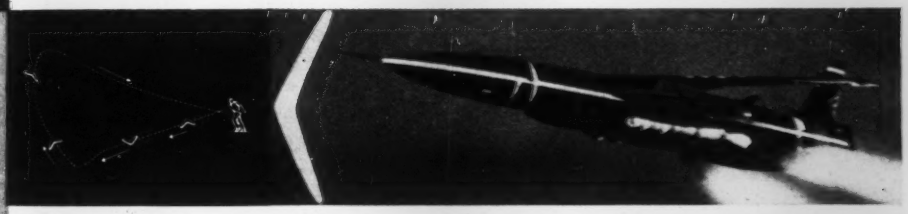
Award-winning Science Research Center



POWERS control system regulates the climate of progress



Powers Pneumatic Thermostats maintain set temperature day after day without daily checking or readjusting. Here they control mixing dampers in Multi-Zone air conditioning units, also re-set submaster thermostats in air discharge from single zone units.



Accurate control – essential for ancient and modern guided missiles

Northrop's SNARK, the world's first intercontinental guided missile, has repeatedly made successful round trip flights over the Atlantic. After traveling up to 3,000 miles they have returned where launched at Cape Canaveral, Florida, landing precisely in a 10 yard circle. Snark is only one of many Northrop products made for the armed forces.

Accurate Control of Thermal Environment

in Northrop's engineering research center contributes to more efficient utilization of creative abilities of engineers and scientists. In the large ultra modern drafting room is one of the nation's extensive "shadow-free" lighted ceilings. Here as in all other spaces optimum temperatures are provided by a Powers Pneumatic Control System.

Powers has the know-how and experience to handle important jobs like this. Users often report – Powers control systems are lowest in annual cost of ownership, they cost less to operate and maintain.

For Your New Building –

ask your architect or consulting engineer to include a Powers Quality System of Temperature Control. You'll benefit from Powers complete responsibility for a correctly engineered control system, proper installation, continuous successful operation and prompt service if required, from offices in 85 cities.

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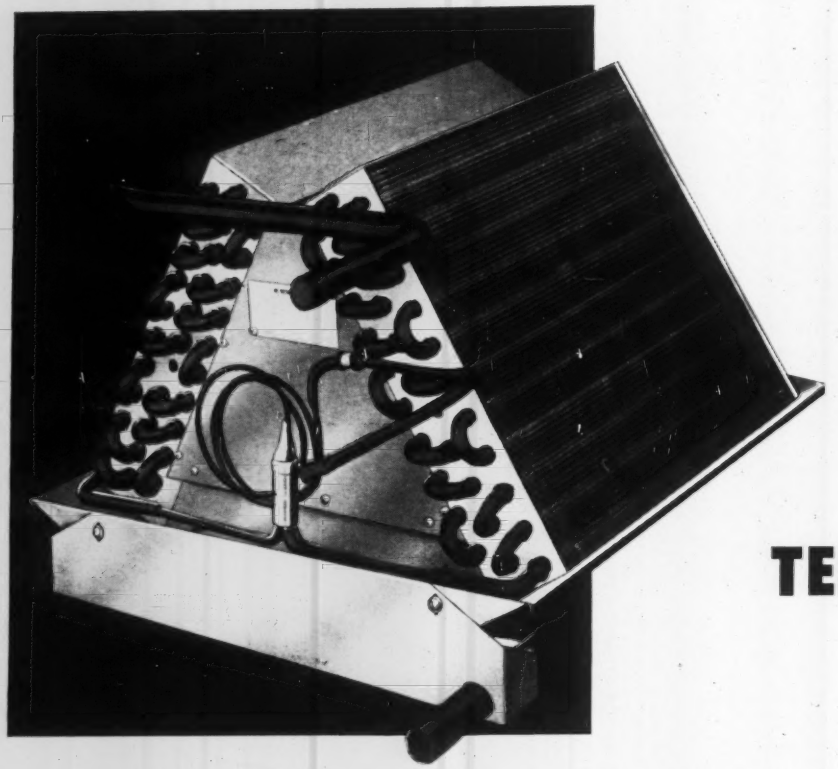
Cafeteria can feed 800 persons in 30 minutes.

Air Conditioned comfort is maintained in the attractive executive offices.



How to **TEMPER** *the* **TEMPERATURE**

MATHES relies on **WOLVERINE TUBEMANSHIP**

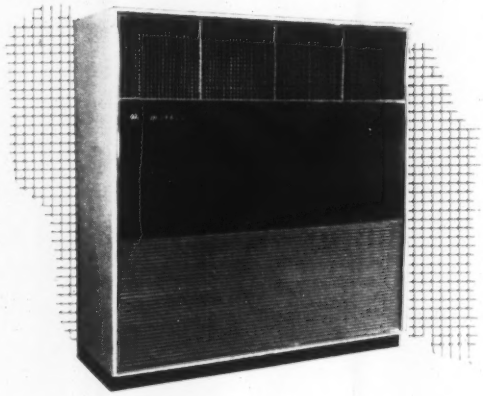
Wolverine supplies the Mathes Company Division of Glen Alden Corporation, Fort Worth, Texas, with three Tubemanship-made products: Precision-drawn Wolverine Capilator®, used for metering; commercial copper tube for hook-ups, condenser and evaporator coils and other fabrications; and aluminum extruded shapes for trim.

Mathes takes great pride in their research and development program for summer winter air conditioning systems. Along with strict quality control, flexibility is their keynote. Simply by selecting from various Mathes components, an architect or contractor can install almost any size job regardless of tonnage requirements.

Incidentally, Mathes backs up their quality story with a written five-year warranty covering condenser and evaporator coils as well as condensers.

Yes, Wolverine contributes to Mathes products just as they do for the many, many others which make up industry's blue book. If you use copper, brass or aluminum tube and shapes, check into the Wolverine story.

Write for the TUBEMANSHIP BOOK—today!



See Wolverine Tube at Booth 519 — 11th Exposition of the Air Conditioning and Refrigeration Industry—November 2 through 5, Atlantic City, New Jersey.

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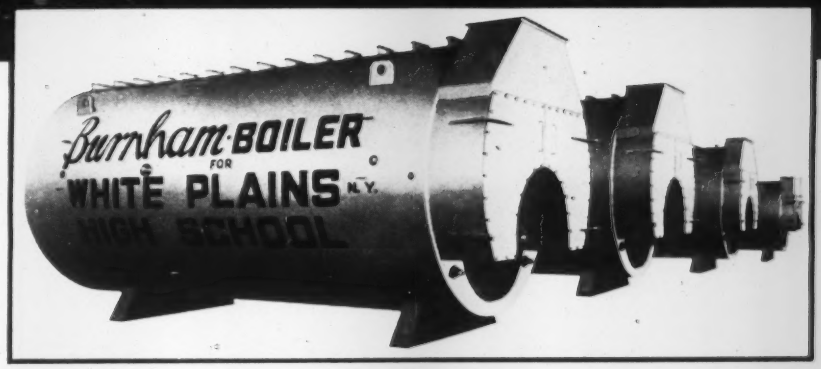
New York City



New "Dream School" heats with giant Burnham Scotch-Type Steel Boilers

Two Scotch-Type boilers of the largest size that can be built as a single unit for transportation are being used in "the dream school of the East" . . . the new High School in White Plains, N. Y.

These efficient Burnham Steel Boilers for heavy oil firing are approximately 10 feet in diameter and 25 feet long. With 4,000 sq. ft. of heating surface, each can develop 800 boiler horsepower. In addition, the school uses two smaller Burnham Scotch-Type Steel Boilers in stock sizes . . . one with 2,500 sq. ft. of heating surface and one with 715 sq. ft.

Burnham Scotch-Type Steel Boilers are also available as completely packaged units. You get the ideal combination of boiler and burner for heavy oil, light oil, gas or oil/gas combination. Standard capacities range from 2,930 to 39,370 sq. ft. net E.D.R. steam.

Also available for prompt shipment: Compact-Type Table I and Table II Steel Boilers

For full information, mail the coupon today.

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Ductwork is easy to fabricate, quickly installed

with USS Galvanized Steel Sheets

THE LAKEWOOD FURNACE COMPANY used USS Galvanized Steel Sheets to fabricate the ductwork in the Struhar Shopping Center in Rocky River, Ohio. Lakewood chose USS Galvanized Steel Sheets for this ductwork because they are easy to form, and even with severe shaping, the zinc will not flake off the base metal. USS Galvanized Sheets have a tight, uniform bond between the zinc and steel.

No other metal can match the strength and low cost of galvanized steel sheets for ductwork. The tensile strength of galvanized steel is about 48,000 psi, compared to 38,000 and 15,000 psi for other ductwork metals. The strength and rigidity of galvanized steel allows longer spans with fewer supports. It makes installation rapid and easy, and it reduces flutter and vibration.

Save money and improve the quality of *your* ductwork. Specify USS Galvanized Steel Sheets for your next heating and ventilating duct job.

USS is a registered trademark

United States Steel Corporation – Pittsburgh
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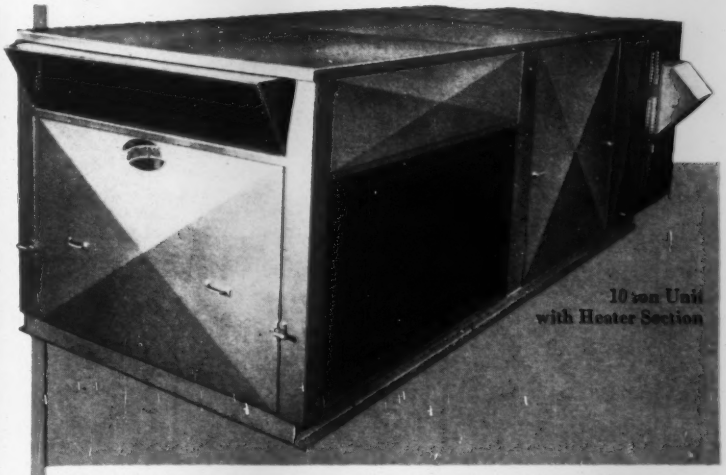
it's time
to take
the credit...



There's always room on top for the original low silhouette.

ATMOS-PAK

the atmos-pak ®

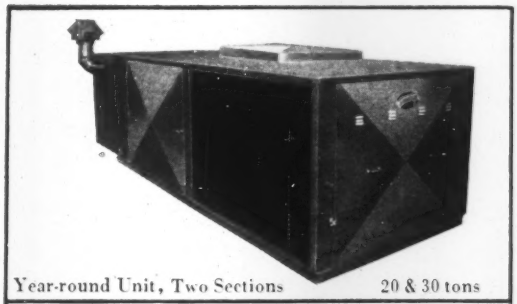
Patent No. 2886935

AIR-COOLED
ELIMINATES DUCT WORK
OCCUPIES NO USEABLE SPACE

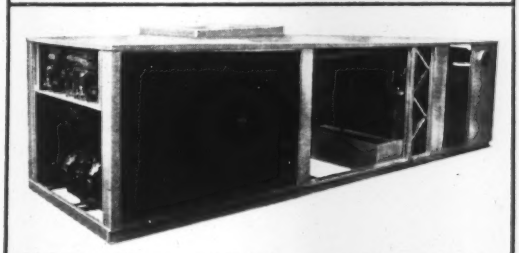
After five years of field development and research, Air Conditioning, Incorporated offers the *original*, pre-fabricated, roof-mounted, year-round air conditioning system in *nine* models of 5 through 30 tons. Our supply and return air ceiling diffuser provides perfection in air distribution and readily adapts to ceiling treatments.

While applicable to existing buildings and varied functional structures, the "Atmos-Pak" is primarily designed for the flat-roofed, one story building. This "packaged" system comes in one section for both heating and cooling in the 5 through 15 ton models; in two sections—cooling and heating—for the larger units. Simple connections to electrical power, to oil or gas supply, and low voltage wiring from the thermostat to a terminal block in the unit, result in complete installation.

Over 300 systems now in operation throughout the east and midwest testify to our rapid acceptance and most thoroughly proven performance. We will be glad to send you our latest bulletin and specification literature on request.



Year-round Unit, Two Sections 20 & 30 tons



10 & 15 ton Year-round Unit Constructed in One Section

designed, manufactured, and pioneered by
AIR CONDITIONING, INC.
88 North Highland Avenue
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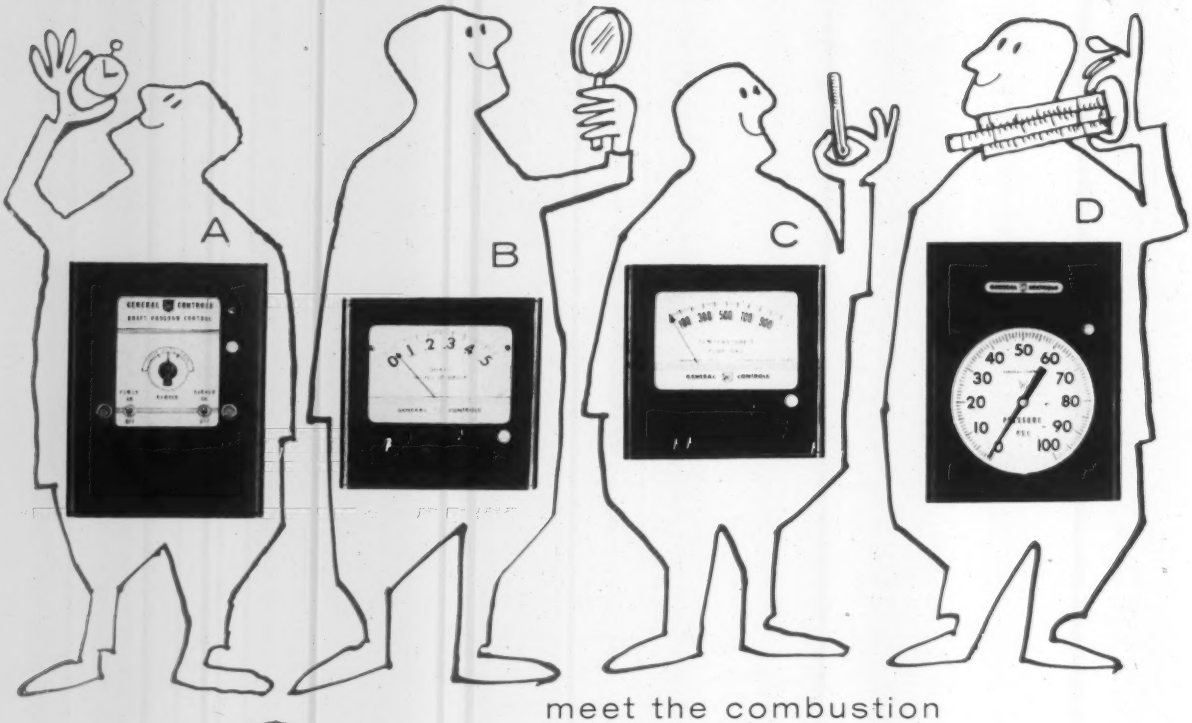

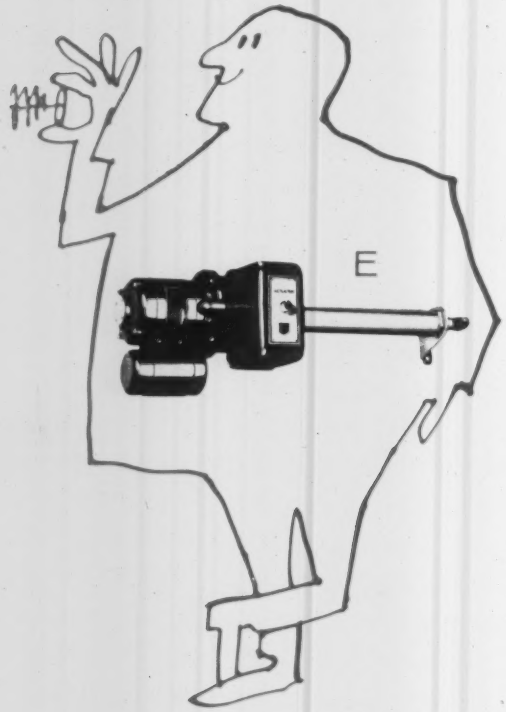

meet the combustion

EFFICIENCY EXPERTS

from GENERAL CONTROLS

Wondering how to step up your boiler efficiency, cut down on costs? General Controls puts a real damper on fuel waste... with a draft control system that pays for itself again and again.

It's the system that goes in easily, inexpensively—with any type boiler, any type fuel. Saves you as much as 25% on fuel. Saves on manpower, too!

You'd better get acquainted with our panel of efficiency experts:

A **DRAFT PROGRAM CONTROL:** Start-up, shut-down, measures draft changes and sets damper for any firing rate. Optional safety feature shuts down boiler when draft condition is unsafe. Fast, accurate... senses atmospheric changes.

B **DRAFT INDICATOR:** Provides continuous visual readings of draft conditions in combustion chamber and/or stack.

C **FLUE GAS TEMPERATURE INDICATOR:** Shows boiler efficiency by indicating excessive heat loss.

D **STEAM PRESSURE INDICATING CONTROLLER:** Indicates boiler pressure on main instrument panel, and gives accurate on-off or proportioning control.

E **ACTUATOR:** Operates stack damper to maintain constant combustion chamber draft.

Call in the GENERAL CONTROLS MAN in your area today to work out a draft control system for your plant. Or get all the facts by return mail from

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Radiant Ceiling News

With Burgess-Manning Ceilings — Your Building Is Better — Your Building Budget No Bigger

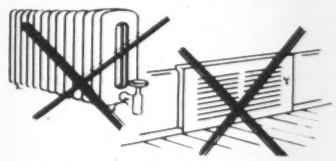
Radiant Acoustical Ceiling Ideal for Psychiatric Hospital

Quiet—Efficient Inaccessible— Safe for the Mentally Disturbed

The efficient, dependable and economical performance of the Burgess-Manning Radiant Acoustical Ceiling has been proved in numerous institutional and commercial buildings.

However, certain of the outstanding features of the Burgess-Manning Radiant Acoustical Ceiling make it particularly desirable as a means of comfort conditioning the psychiatric hospital. Were it designed for exclusive use in psychiatric hospitals, the Burgess-Manning Radiant Acoustical Ceiling could not be better suited for this type of institution.

No Heated Surfaces Within Reach



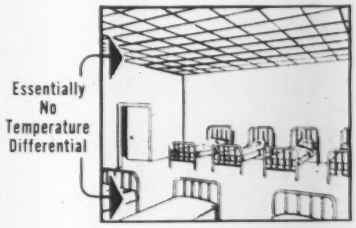
There are no hot radiators or registers, that might harm a mentally irresponsible patient, within reach. All thermostatic controls can be located where only authorized supervisory personnel have access to them.

No Heated or Cold Air Currents

With the Burgess-Manning Radiant Acoustical Ceiling, comfort conditioning is accomplished by radiant energy, not by convection air currents. Consequently there are no hot or cold drafts with potentially deleterious effects on patients, particularly those who are mentally incapacitated. Any air movement is limited to that required for ventilation only.

Uniform Temperatures Throughout Room

With radiant ceiling heating, temperatures are uniform in all parts of the room. Even adjacent to windows, there are no cold or hot areas to aggravate patients, or to induce colds. Room temperatures are uniform from floor to ceiling as well.

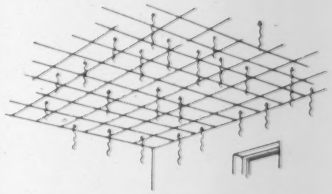


Floors Are Always Warm

With these mentally disturbed patients, and with children as well, it is important that floors are warm. This is one of the principal advantages of radiant ceiling heat. The radiant energy from the ceiling is converted into heat only when it is intercepted by a solid object, and the floor in almost every room receives the largest part of the radiant energy emitted from the ceiling. Therefore, the floors are always fully as warm as other parts of the room, rarely true with other older types of heating.

Cooling Equally Efficient

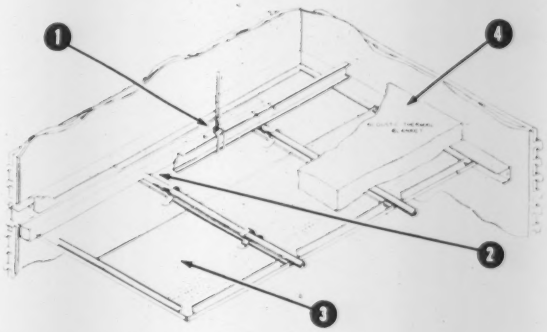
On the cooling cycle, the Burgess-Manning Ceiling operates in reverse. The



cool water circulated in the coils, absorbs radiant energy from the room and reduces the sensible heat of the room.

Basically Simple, But Amazingly Efficient

The deceptively simple construction of the Burgess-Manning Radiant Acoustical Ceiling is scarcely indicative of its operating efficiency. A standard 1½" channel grid (1) supports a grid or sinuous type galvanized coil (2). Perforated aluminum panels (3) are fastened directly to the coil (2) and a sound absorbent blanket (4) is laid on top of the suspension grid (1). Thermostatically controlled hot water circulates through the coil (2) and warms the aluminum panels (3) which transmit radiant energy to the floor, walls, furniture and occupants of the room and provides a high degree of comfort conditioning. On the cooling cycle, the process is reversed so that cool water, with temperature above the dew point to eliminate condensation, cools the panels. The cool panels absorb radiant energy (heat) from the objects, floor and walls of the room.



Write for descriptive Burgess-Manning Catalog No. 138-2H

Heating Cooling Acoustical

BURGESS-MANNING COMPANY

Architectural Products Division

749 East Park Avenue, Libertyville, Illinois

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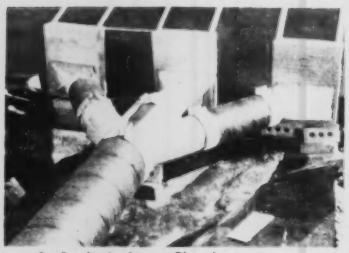
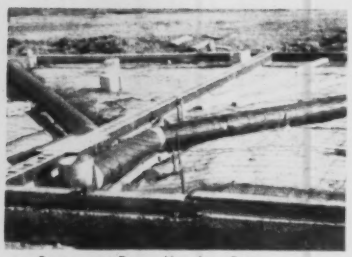
FIBRE DUCT

America's Best Selling Fibre Duct

Taylor University, Upland, Indiana; Oris Eash, Fort Wayne, Ind., architect



St. Paul's Lutheran Church, Dallas, Texas; Stone Company, sub-contractor, Dallas.



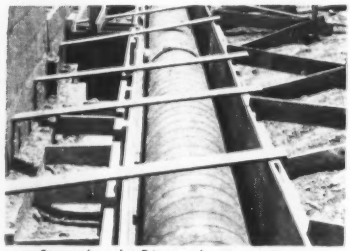
Permanent Troop Housing, Fort Campbell, Ky.; Arthur C. Harpring Co., heating, Louisville, Ky.

For slab perimeter heating and combination heating and cooling

SONOAIRDUCT, the original fibre duct, has proven to be the most dependable for satisfactory performance. Over the years, SONOAIRDUCT has been widely accepted by builders and contractors for all types of slab perimeter system installations in residences, shopping centers, motels, schools, churches and industrial facilities. Its use permits savings on both initial cost and installation . . . without lowering the quality of construction. The long lengths are easy to handle and level fast. There are no sharp, cutting edges, and it will not crack, chip or break when dropped. Every piece is usable!

SONOAIRDUCT is made in 23 sizes—2″ to 36″ I.D., in standard shipping lengths of 18′. Special sizes are also available. Can be cut to exact lengths with a hand saw. Meets and exceeds F.H.A. criteria and test requirements for products in this category. Free installation manual sent on request. See our catalog in Sweet's.

For complete information and prices, write—



Stoneybrooke Estates, Inc., Warwick, Va., recreation center. Ralph Huskey, heating contractor.

Permanent Housing, Fort Benning, Ga.; Southern Air Contracting, Inc., Columbus, Ga., heating contractor.

10-ton residential heat pump installation, Greensboro, N. C. Dick & Kirkman, mechanical contractors.

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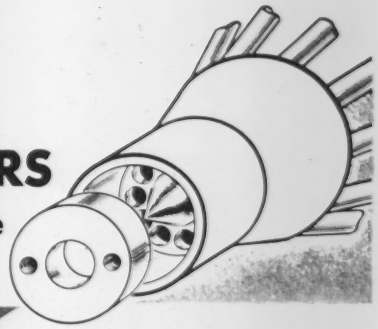
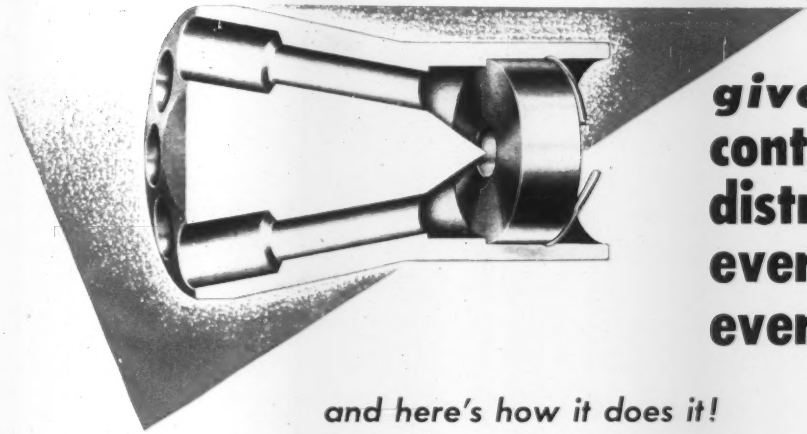
Sporlan

REFRIGERANT DISTRIBUTORS

with the Versatile Interchangeable Nozzle

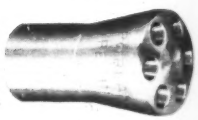


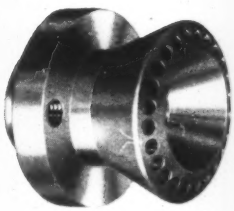


give controlled distribution *to* every circuit... every time!

and here's how it does it!

The velocity of the liquid-vapor mixture of the refrigerant is increased by the flow through the nozzle orifice. Also the turbulence created by the pressure drop causes a homogenous mixture of the liquid and vapor. This refrigerant mixture, while still at high velocity, is then immediately deflected by the conical button and fed equally to each circuit.





in addition . . . the versatile interchangeable nozzle affords custom selection for any refrigerant or capacity. Coils can be stocked with distributors already attached and proper capacity nozzles can be selected either before delivery or on the job.

The removable nozzle simplifies visual, air, or test wire inspection at coil and distributor connections. Final coil and distributor leak test made easy prior to valve installation.

Get controlled distribution to every circuit, every time . . . buy Sporlan Refrigerant Distributors with the Versatile Interchangeable Nozzle for Peak Performance on all direct expansion multi-circuit evaporators, regardless of load or temperature. Better still, buy Sporlan Right Down the Line and get Peak Peformance throughout!

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Skidmore Pumps gives PEAK PERFORMANCE

Right Down the Line!

Skidmore Corporation's complete line of heating pumps affords a type and capacity for every general or special installation. Available in both single or duplex units with close-coupled and mechanical shaft-seal. Low installation cost and maintenance with peak performance are assured from every type or size—Right Down the Line.

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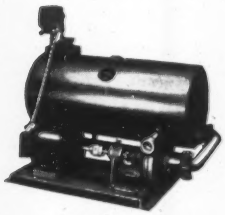
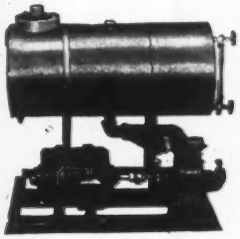
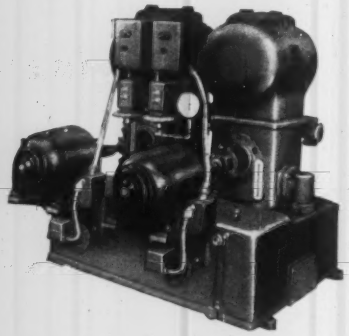


"HS" TYPE



"TM" TURBINE



The Skidmore Vacuum and Boiler Feed Pump is famous for "maintained efficiency" . . . liberal clearance between moving parts positively eliminates wear. Capacities range from 5,000 to 100,000 sq. ft. EDR.

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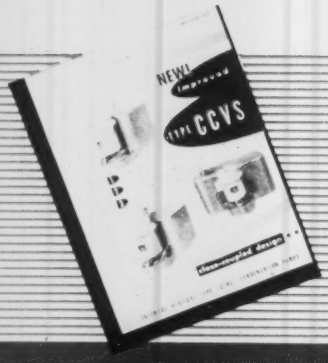

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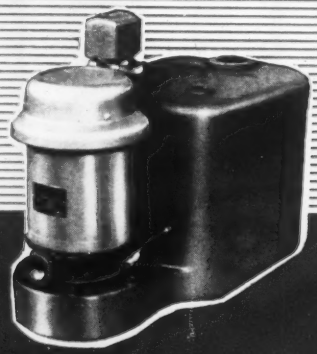

The new SKIDMORE CCVS Vertical Pump features *close-coupled* design and *mechanical shaft-seal*. The single unit is built with 5, 10 and 20 gallon receivers. The duplex unit is designed with two float switches or automatic alternator. Capacities for the new CCVS Pump range from 500 to 10,000 sq. ft. E.D.R. Write for complete engineering data.

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Sales Representatives in Principal Cities

Since 1921

SKIDMORE PUMPS

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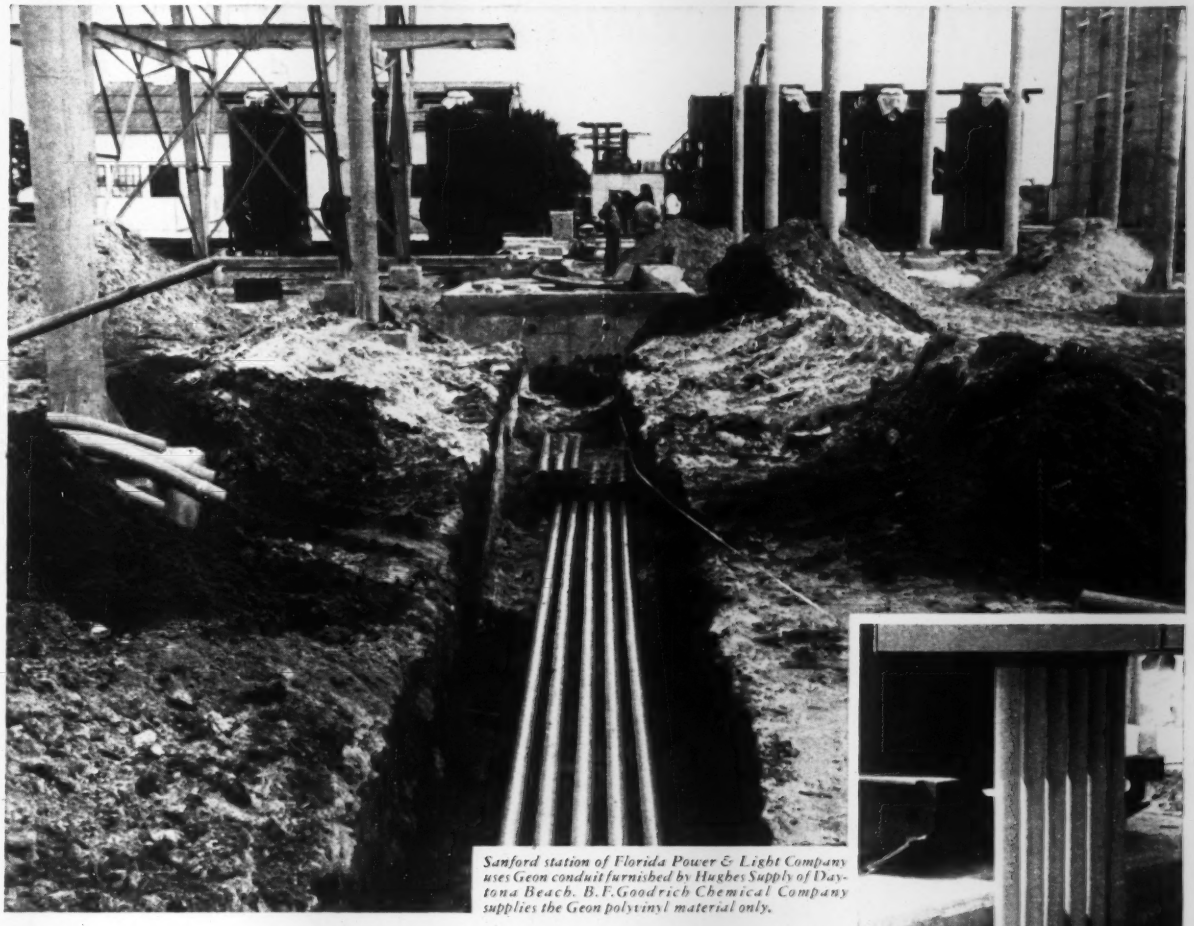

Sanford station of Florida Power & Light Company uses Geon conduit furnished by Hughes Supply of Daytona Beach. B.F.Goodrich Chemical Company supplies the Geon polyvinyl material only.

corrosion problem knocked out . . .

generating station gets conduit of Geon

YEARS from now pulling new cable through this conduit made from Geon polyvinyl materials will be just as easy as it is today. Unlike ordinary steel conduit, Geon conduit resists the corrosive effect of salt water, gases, chemicals and acid or alkaline soils. Internal and external surfaces stay smooth—like new.

Conduit or pipe made from Geon offers high tensile or impact strength. It stands up under pressure . . . is not subject to galvanic corrosion. It resists sunlight, fungi, bacteria, moisture, heat and cold. And its light weight makes installation especially easy.

Engineers are taking advantage of properties of pipe and conduit of Geon in a wide variety of applications. For information, write Dept. AX-4 B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

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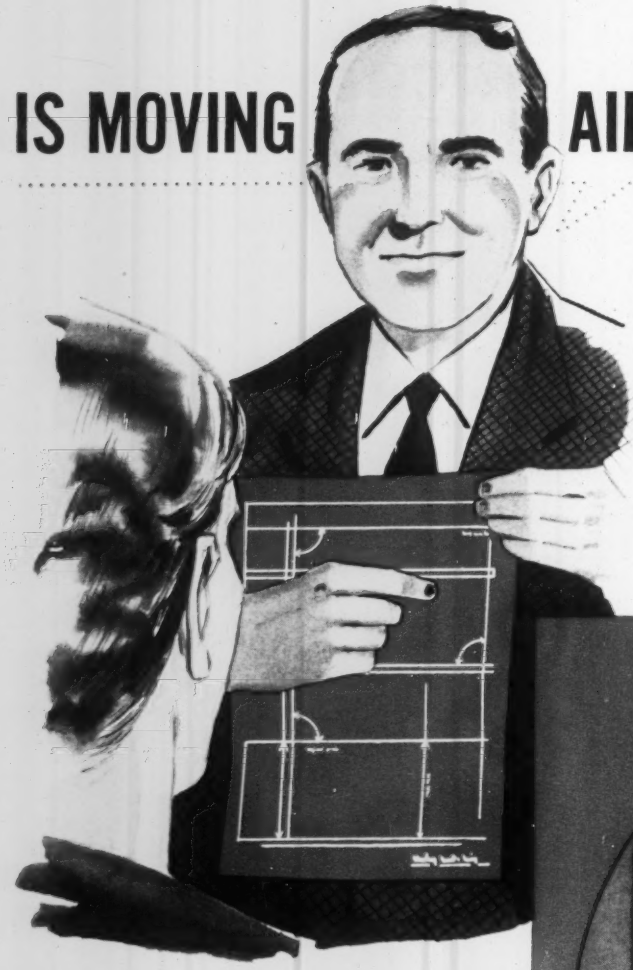

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do the job better
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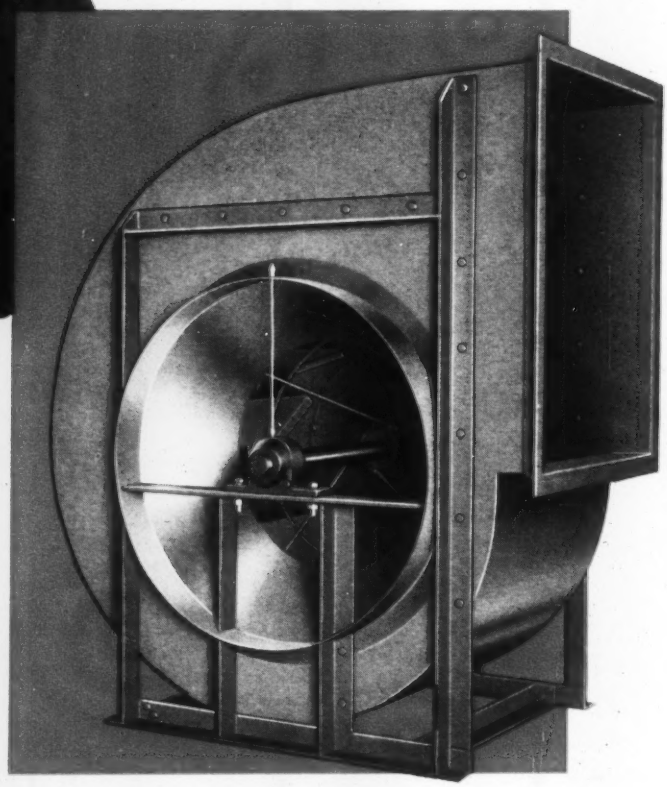
designed to fit
your special needs!



BARRY blowers represent the most dependable and economical solution to your air moving problems. BARRY can supply you with *exactly* the right blower for your specific application—all types and sizes from 6″ to 73″ impellor diameter. BARRY will give you speedy delivery on any unit—assuring you of "on schedule" completion of your project. For fastest service and highest quality centrifugal fan equipment —always specify BARRY!

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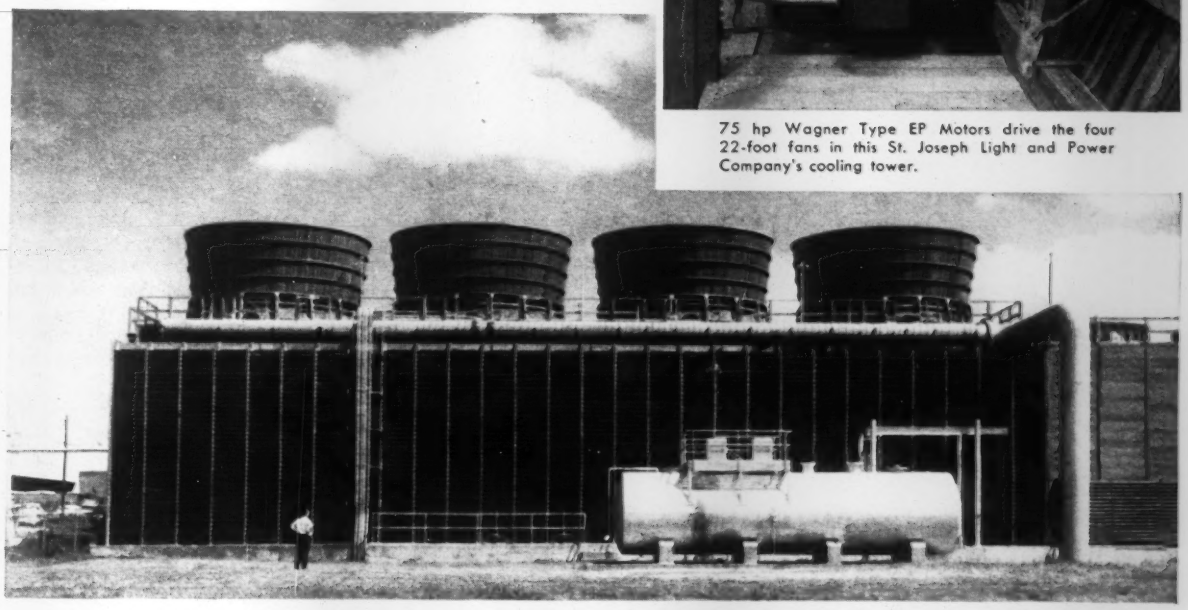
Tower for Power
COOLS 28,000 GALLONS OF WATER PER MINUTE

75 hp Wagner Type EP Motors drive the four 22-foot fans in this St. Joseph Light and Power Company's cooling tower.



This Marley Double-Flow 4-cell cooling tower, at St. Joseph Light and Power Company, cools water at the rate of 28,000 gallons per minute to get more kilowatts from steam.

Driving 22-foot cooling tower fans is a job for rugged motors—motors that must operate without attention month after month, completely exposed to all kinds of weather and to constant high humidity, the number one cause of motor failure in cooling tower applications.

The Wagner Type EP Motors used on this tower meet these requirements. All vital parts are totally-enclosed for extra protection against fumes, dust and moisture . . . and the frames, endplates and conduit box are made of heavy cast iron for extra protection against high humidity and corrosion.

These versatile standard motors can meet your requirements for motor drives that must operate under adverse conditions. They are available in ratings through 500 hp. Call your nearby Wagner field engineer, or write for Bulletin MU-224 (Covers standard and explosion-proof totally-enclosed fan-cooled motors).

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Hockey—"the fastest game in the world"— is rapidly becoming America's number one winter spectator sport. For years, players from Canada—where the temperatures favor hockey all winter long—have dominated the National Hockey League. Recently, however, an increasing number of American schools and colleges have installed artificial ice rinks on the campus. As a result, we may soon see more hockey players from the U.S. making the pro teams.

New air-conditioned office buildings like this are changing New York City's skyline every day. By 1960, it's expected that more than 50% of major office space in Manhattan will be air-conditioned.

Photo courtesy Carrier Corp.

School rooms never used to be like this! Today's classrooms are lighter, brighter—and more comfortable, thanks to modern air-conditioning systems that keep temperatures level and end drafty or stuffy classrooms.

Photo courtesy Brunswick-Balke-Collender Co.

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the zone control valve with

100% SHUT OFF

for positive temperature control!

Globe-type construction of Zonvalve guarantees complete shut-off on steam, hot and chilled water systems. This means positive temperature control, without heat waste.

Engineer-architects and heating men recognize the superiority of Zonvalve's design features. Self-aligning plug insures positive closure and eliminates jamming. Valve is powered by a heavy-duty motor, with pinion, gear and cam assembly—for extra-long life and silent, dependable operation. Zonvalve's "hand-size" compactness makes installation possible where space is limited. Zonvalve is the *only* valve that uses Teflon for a self-lubricating, permanent seal.

Zonvalve is competitively priced. Built to last a lifetime, *it is the only zone control valve with an unconditional written Five-Year Guarantee!*

Zonvalve is ideal for modernization and new construction, in residential, commercial and industrial zone heating. For the finest in zone control equipment—specify Zonvalve, install Zonvalve!

New color brochure contains layouts, applications, customer benefits, technical data and prices. Write for Brochure P-9.

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AVAILABLE IN SIZES FROM ½" TO 1¼"

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for complete... sure... permanent... low cost

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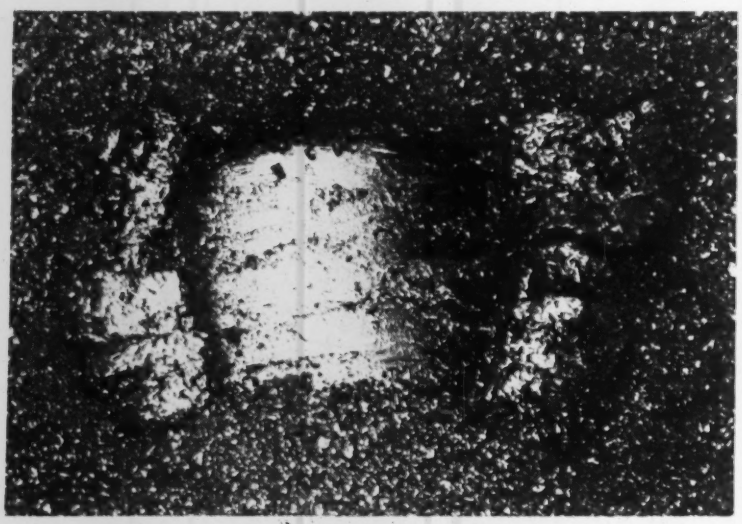
Specify and Use.....

TRI-SUL-ITE

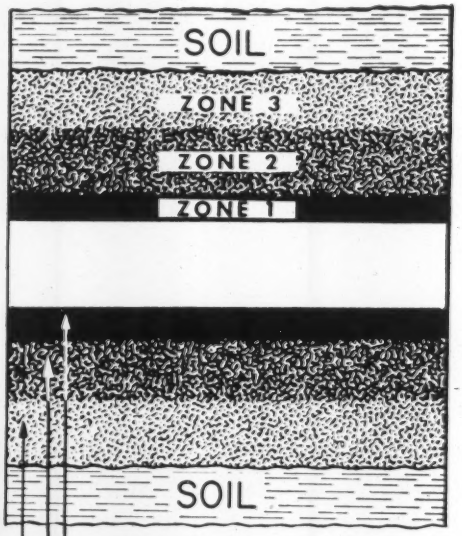
3-WAY PROTECTION SYSTEM *

THE ZIEGLER GILSONITE MINERAL

Looking for an underground piping system that's free from excessive heat loss... yet gives the greatest protection possible from corrosive soil conditions? A system with a low installation cost and minimum maintenance expense? Then TRI-SUL-ITE 3-way protection system is your answer. TRI-SUL-ITE installations have proven to be the speediest... easiest... surest underground pipe protection. TRI-SUL-ITE, a specially selected gilsonite, is poured under and around all pipes in the trench. After proper curing, it forms three zones of protection against water, corrosion and heat loss.



Close-up photo illustrates the plastic zone of TRI-SUL-ITE peeled back to show excellent adhesion for pipe protection.



* ZONE 1 PROTECTION:
PERMANENT WATER BARRIER

The first zone of TRI-SUL-ITE adjacent to the pipe, fuses from pipe heat into an impermeable, waterproof coating. It resists normal soil acids and alkalis. When it is plastic the pipe movement is contained within this zone. The first zone of TRI-SUL-ITE protection gives positive assurance that water cannot follow the grade of the pipe.

* ZONE 2 PROTECTION:
EXCELLENT INSULATOR

The second zone consists of the edges of the TRI-SUL-ITE granules fused to isolate the air spaces, resulting in a highly effective insulator which minimizes heat losses to the soil.

* ZONE 3 PROTECTION:
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The third zone of TRI-SUL-ITE granules is not fused by heat and provides maxium insulating efficiency plus good resistance to water penetration and protection against surface shocks and subsoil stresses.

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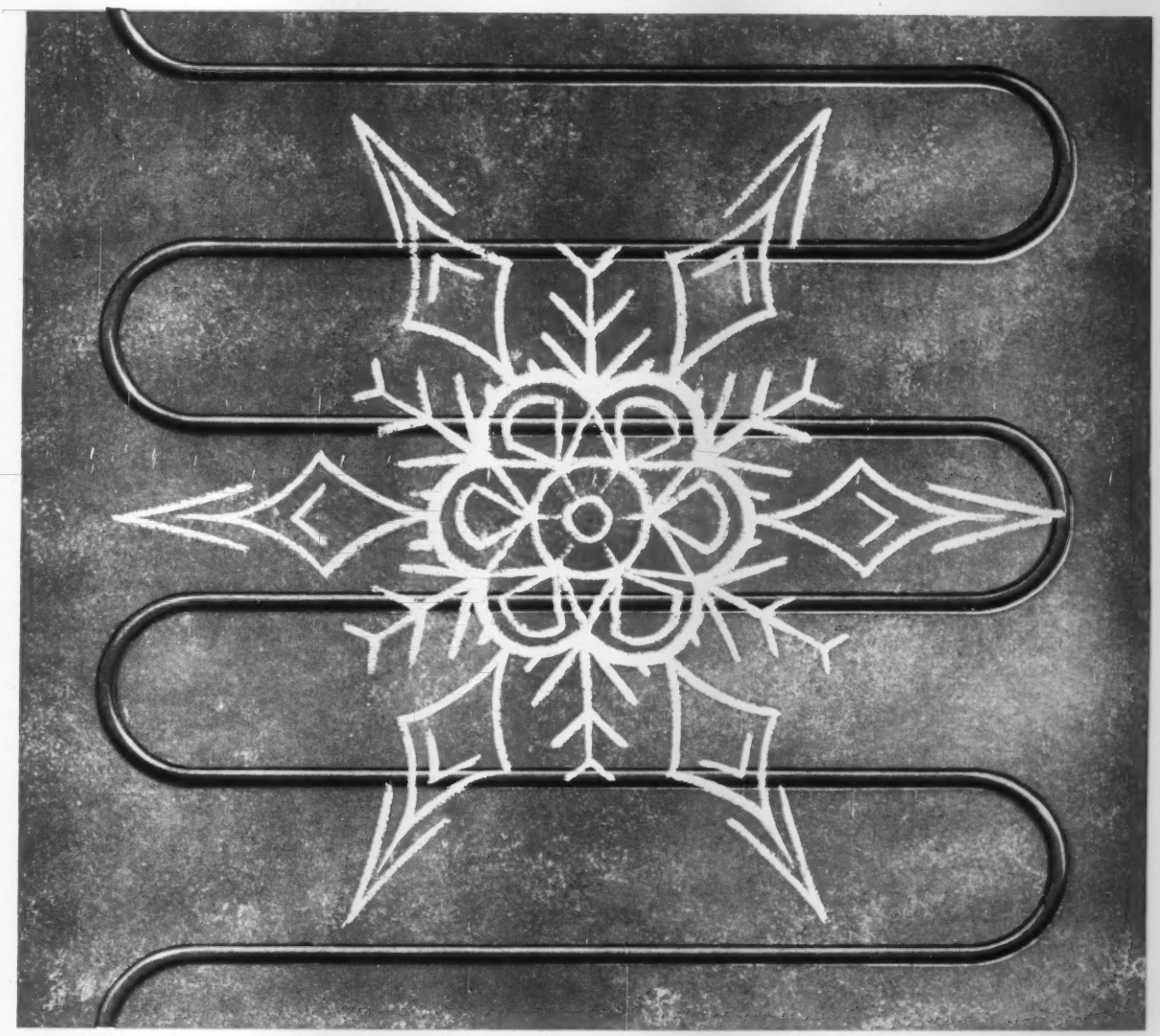
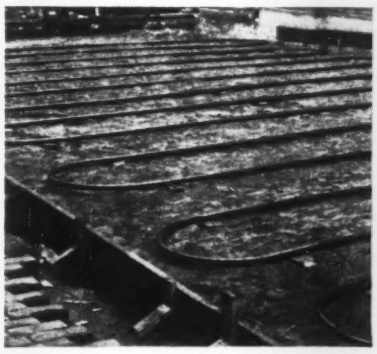


This snowflake never had a chance



. . . to cause trouble. A SPANGRID Steel Pipe snow-melting system under the paving where he landed turned him to water . . . fast!

HEAT UP SOME PROSPECTS NOW while the weather is still good. Sell them on installing a steel pipe snow-melting system. Point out how they'll save future labor and material costs for snow removal . . . prevent accidents . . . keep walks, drives and loading docks open 365 days a year (366 in leap years). And, of course, you'll want to use that top-quality, easy-to-work-with, economical SPANGRID Steel Pipe for the installation.

YOUR CUSTOMERS WILL GET THE DRIFT with a little effort on your part. We'll help, too. That informative booklet, "Snow Melting Systems," is available for you to pass out to your customers. Your regional SPANG Sales Office can obtain a supply for you. Order them . . . use them . . . and install those snow-melting jobs you land as a result with SPANGRID Steel Pipe.

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SPANG CW STEEL PIPE

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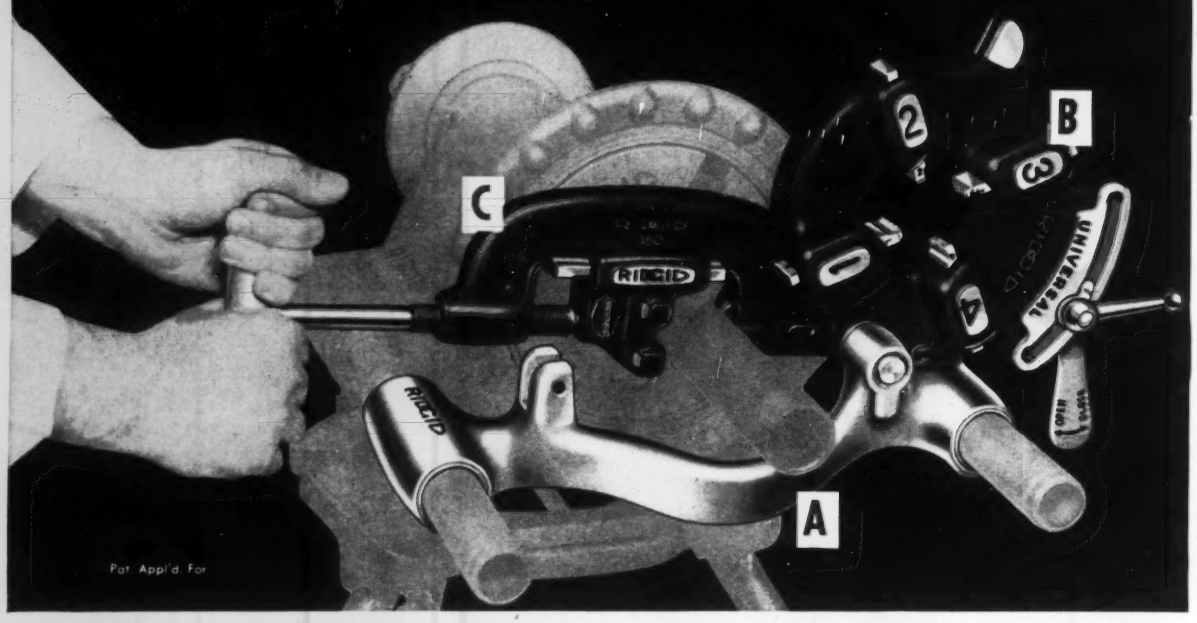
TWO GATEWAY CENTER, PITTSBURGH, PA.

Now!... Convert Your RIDGID 300 POWER DRIVE to a fast, smooth, low-cost pipe and bolt threading machine!



"3 Efficient, New RIDGID Accessories Save Me Time on Every Job!"

A **RIDGID No. 310 Carriage** — Slip this strong, lightweight aluminum alloy carriage on the support arms of your RIDGID 300 Power Drive, and you'll get real cut-and-thread efficiency! Holds die head and cutter at your fingertips exactly like a pipe machine. No fumbling for right size threader . . . no tools to drop. Easy sliding . . . snugs right up to chuck for close threading and cut-off.

B **RIDGID Die Heads** — The time-saving RIDGID 535 Quick-Opening Die Head shown here, or any other RIDGID Machine Pipe and Bolt Die Head, snap-locks into carriage quickly, easily... eliminates slow back-off. Single adjustment on carriage centers die head exactly for true threads every time.

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Die head and cutter operate independently . . . swing up and stay out of way when not in use. Add a RIDGID No. 19 Nipple Chuck and you can thread close nipples.

For a bargain in fast, easy work, equip your RIDGID 300 Power Drive with these accessories . . . available individually . . . at your Supply House!

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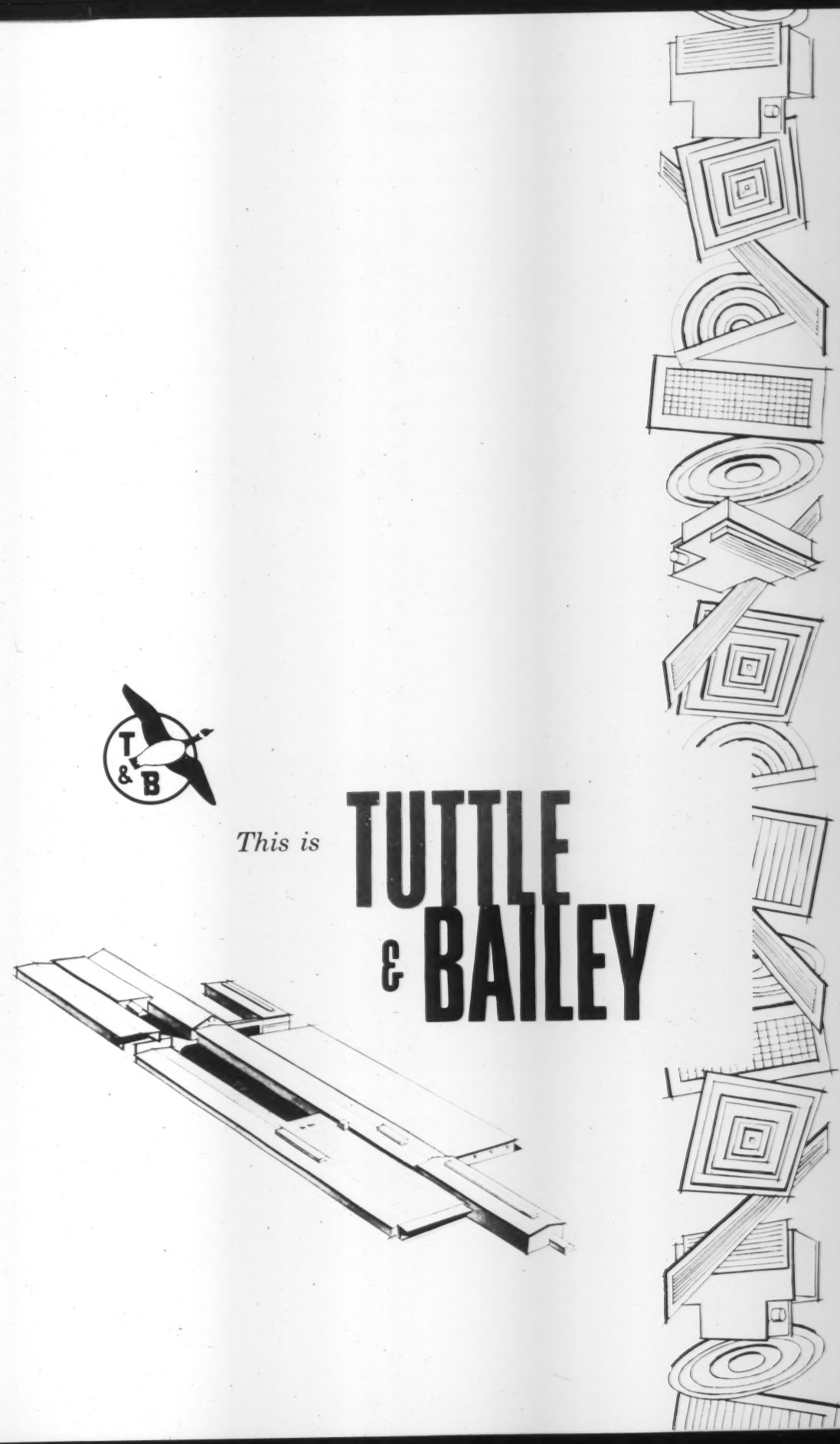

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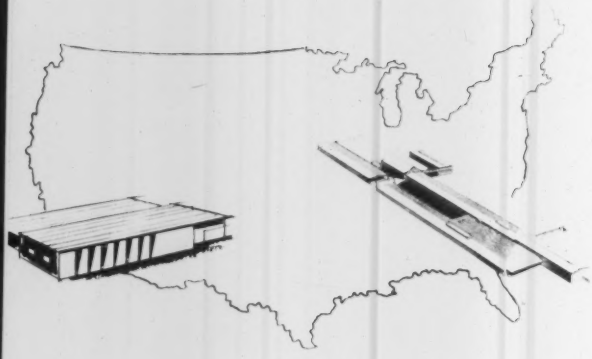
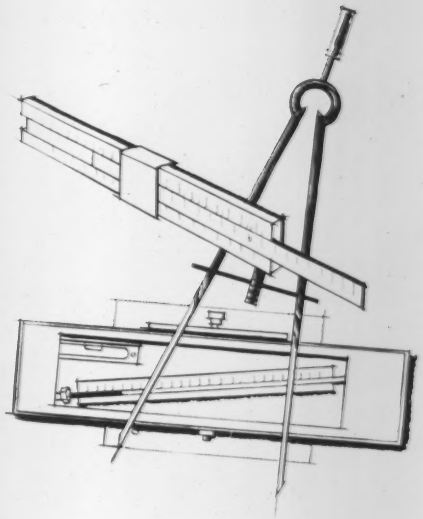
Scope of product lines, manufacturing and research laboratory facilities, nation-wide distribution, product acceptance—these are the areas in which Tuttle & Bailey has established a unique position of leadership in the air distribution industry.

As the first and largest full-line manufacturer, Tuttle & Bailey has pioneered a broad range of air distribution devices and accessory equipment for heating, cooling and ventilating. Until a few years ago, these products were primarily designed for low pressure systems. However, with the advent of high pressure systems, Tuttle & Bailey was one of the first to recognize its significance and is now a leading producer of high pressure attenuation units and related equipment.

To meet the ever-expanding market, Tuttle & Bailey maintains complete manufacturing and laboratory facilities on the East and West Coasts, and is the only company in the industry with plants so situated. In both locations, streamlined production methods, skilled supervisors and workers, the most modern high-speed production machinery and an effective quality control system combine to provide customers with consistently top quality products, efficiently produced and competitively priced.



Meeting the immediate needs of the present—and anticipating the needs of the future as dictated by constantly changing building design concepts—are the projects that keep T&B's large, well-equipped laboratories busy. Engineers, rich in field experience as well as theoretical training, work with the latest test equipment and instrumentation. Ample space permits construction of mock-ups to simulate actual

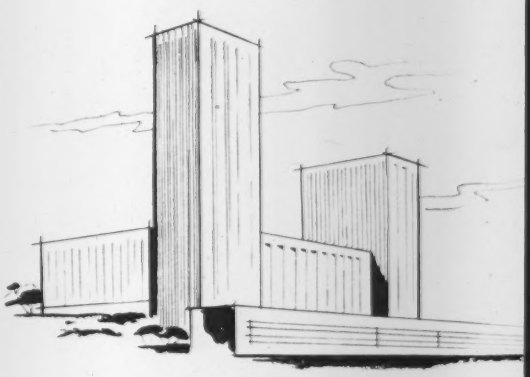


job conditions for the pre-testing of system design and equipment to insure installations that will perform with maximum efficiency.

Representatives, strategically located in principal cities, offer the services of engineering and sales personnel fully qualified to work closely with architects and engineers in helping to solve air distribution problems. With a full knowledge of Tuttle & Bailey products and their applications, they have the background and experience needed to recommend the types of equipment best suited to a particular job. . . and to follow through on every installation detail. In addition, many offices have warehouse stocks of low pressure distribution devices in standard sizes that will meet the majority of job requirements. The names and addresses of these Factory Offices and Sales Representatives are listed on the next page.

Evidence of the acceptance of Tuttle & Bailey products is the impressive list of T&B installations in many of the nation's outstanding office buildings, department stores, schools, commercial and recreational buildings, institutions and industrial plants. From experience, the leading architects, consulting engineers and mechanical contractors—the men responsible for specifying and installing these systems —know that T&B air distribution equipment is designed and engineered to meet their highest standards of appearance and performance, two factors that must always be present to insure owner satisfaction.

Thus, in breadth of lines, manufacturing and laboratory facilities, nation-wide availability and acceptance . . . this is Tuttle & Bailey.



TUTTLE & BAILEY

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Birmingham, Alabama

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Phoenix, Arizona

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Fresno, California

NORMAN S. WRIGHT & CO.
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Los Angeles 26, California

NORMAN S. WRIGHT & CO.
1102 T St.
Sacramento 14, California

NORMAN S. WRIGHT & CO.
1015 Folsom St.
San Francisco 3, California

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P. O. Box 5304—Terminal Annex
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R. J. CLARK EQUIPMENT CO., INC.
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P.O. Box 989
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R. J. CLARK EQUIPMENT CO., INC.
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P.O. Box 6454
Jacksonville, Florida

R. J. CLARK EQUIPMENT CO., INC.
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P.O. Box 37293
Miami 37, Florida

R. J. CLARK EQUIPMENT CO., INC.
P.O. Box 6913
Orlando, Florida

MANUFACTURERS SALES CO.
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P.O. Box 2163
Pensacola, Florida

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Division of Allied Thermal Corp.
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Chicago 10, Illinois

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541 Kinnaird
Fort Wayne, Indiana

JACKSON ENGINEERING CO.
1531 N. Pennsylvania St.
Indianapolis 4, Indiana

JACKSON ENGINEERING CO.
P.O. Box 25
Lowell, Indiana

INDIANA (Continued)

JACKSON ENGINEERING CO.
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Evansville 10, Indiana

IOWA

HAROLD F. SMITH
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Davenport 1, Iowa

WELLS SALES COMPANY
1429 Second Ave.
Des Moines 14, Iowa

KANSAS

HEAVEN ENGINEERING CO.
830 N. Main St.
Wichita, Kansas

KENTUCKY

JACKSON ENGINEERING CO.
660 South 5th St.
Louisville 2, Kentucky

LOUISIANA

W. C. MURPHY & ASSOCS.
Recile Bldg., Rm. 207
6270 General Diaz St.
New Orleans, Louisiana

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F. C. CLIFFORD, INC.
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MASSACHUSETTS

BRENTON & HART CO., INC.
66 Laurel St.
Watertown 72, Massachusetts

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NEW YORK

R. D. MARSHALL & CO., INC.
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ENGINEERED AIR ASSOC.
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Buffalo 14, New York

TUTTLE & BAILEY
Division of Allied Thermal Corp.
420 Lexington Ave.
New York 17, New York

DONALD J. HOEFFEL
c/o Engineered Air Associates
134 Resolute St.
Rochester 21, New York

COLEMAN J. KANE
Room 1105—State Tower Bldg.
Syracuse, New York

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c/o Kirk Cousart & Assocs.
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Greensboro, North Carolina

KIRK COUSART & ASSOCS.
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P.O. Box 2155
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Oklahoma City 12, Oklahoma

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Portland 1, Oregon

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MCGEE-FEHER CO.
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Pittsburgh 21, Pennsylvania

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P.O. Box 1696
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P.O. Box 5206
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525 Glazebrook St.
Corpus Christi, Texas

J. R. DOWDELL & CO.
3160 Irving Blvd.
P.O. Box 10666
Dallas 7, Texas

J. R. DOWDELL & CO.
204-D Trinity Building.
600 Bailey St.
Fort Worth, Texas

HERLIN ENGINEERING CO.
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P.O. Box 512
El Paso, Texas

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P.O. Box 903
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FRANK HOWELL COMPANY
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P.O. Box 36
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NORMAN S. WRIGHT & CO.
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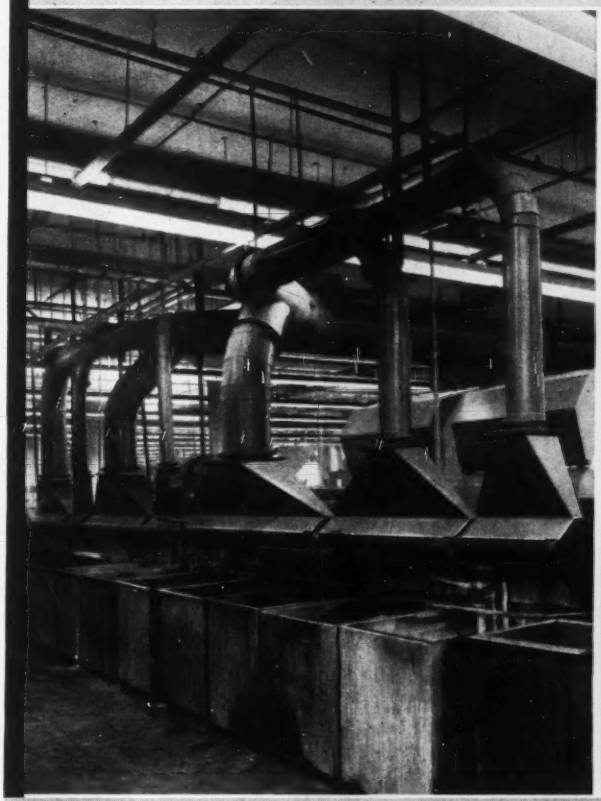
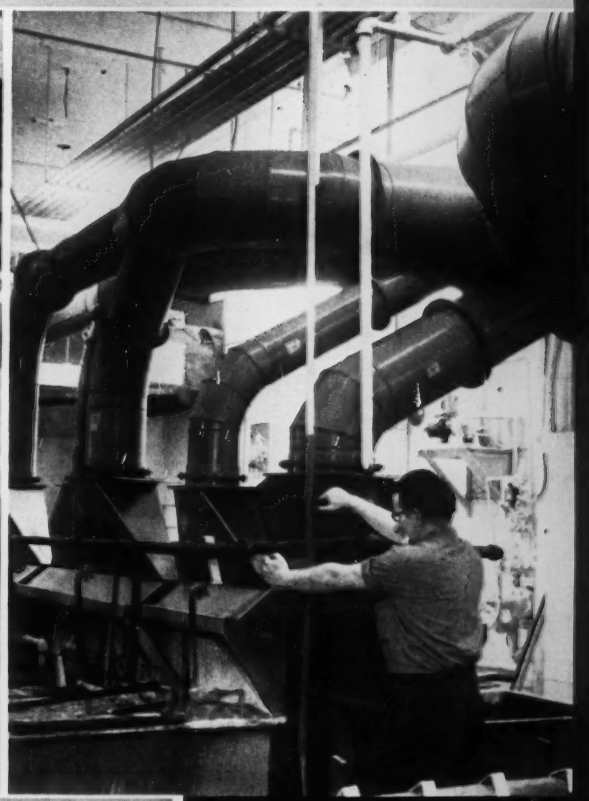
Industrial Plastic Fabricators, Inc. reports . . .

Complete Boltaron 6200 installation . . . ducts, tanks, hoods, blowers





Boltaron® 6200

handles chemical & industrial fumes safely and economically

Boltaron 6200

IS BEST BECAUSE:

- Protects against most corrosive fumes and liquids in any combination.
- Resists build-up of residual materials from corrosive fumes and liquids.
- Solid Boltaron has no coatings to peel or chip —does not require recoating or repainting.
- Chemically inert.
- Non-toxic, imparts no taste or odor.
- Can be welded, bolted, threaded, milled, ground, buffed and polished.
- Non-sparking—will not support combustion —handles fumes and liquids.
- High dielectric strength.
- Extremely lightweight—non-porous—and smooth surface.
- Tensile strength is 8000 psi.
- Can be joined by heat welding, solvent cementing, and threading.

IPF systems fabricated from Boltaron 6200 are being used the nation over by many progressive manufacturers to solve numerous industrial problems, especially where corrosive fumes and liquids have been extremely costly to handle. Performance proves Boltaron 6200 systems help decrease operating costs—increase operating efficiency.

For further information on performance-proven Boltaron 6200 systems, call or write:

Industrial Plastic Fabricators, Inc., Endicott Street, Norwood, Mass.

THE GENERAL TIRE & RUBBER COMPANY • Bolta Products Division • Lawrence, Mass.

SMOOTH, "CUSHION" START

with new Century Electric part-winding start motor

This new motor . . . at either 1200 or 1800 rpm's . . . will give you smooth, "cushion" acceleration. No cogging, jerking or jarring equipment. No sub-synchronous stalling. Just dependable torque with the same 40% reduction in starting current of all Century Electric part-winding motors.

New winding—A special winding scheme makes this extra smooth start possible. Special cross connections are made between coil groups of the basic motor winding. Result: balanced stator field on first step position . . . no cogging . . . smooth acceleration. Means that now motors will give better performance on part-winding start. Also, more time can be taken for acceleration because the winding does not go "across the line" until the rotor has reached a higher speed.

Applications—Have an application where power company restrictions limit in-rush current? The complete line of Century Electric part-winding start motors is the answer. They provide the most economical and dependable way of starting equipment with low-starting torque such as fans, blowers, centrifugal pumps, and compressors, as well as reciprocating compressors equipped with unloading valves. And with new Century Electric part-winding motors heavier loads than ever before can now be brought smoothly up to speed.

Construction—Century Electric part-winding start motors are available in approximate range of 20 to 150 hp sizes and in speeds of 1200 and 1800 rpm. They all have the high quality construction features of all Century Electric squirrel cage induction motors . . . coils are insulated with tough polyvinyl acetal resin . . . windings are dipped and baked with several coats of high temperature synthetic varnish which protect against oil fumes, mild acids and dust and grit . . . rotors are dynamically balanced so that motors run with extreme quietness and smoothness . . . rugged cast iron frame construction assures long life and low noise level.

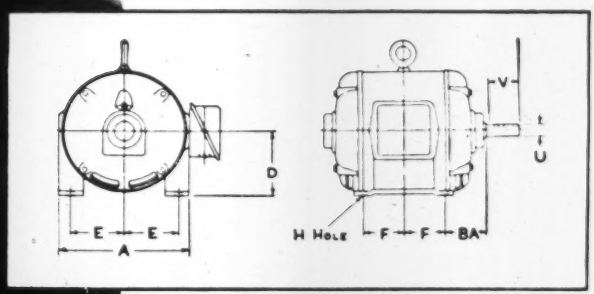
Application aid—A Century Electric application engineer will be glad to discuss your part-winding start problems with you. Century Electric also makes a complete line of motors . . . all sizes and types from 1/20 to 400 hp. For a copy of the new Century Electric Motor Application Guide, please write for bulletin 270A.

CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

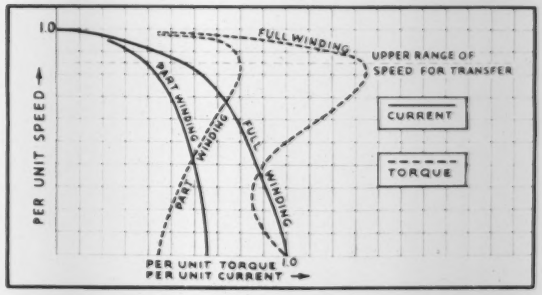
Century

59-10



TYPICAL 30 HP part-winding start motor dimensions

Frame Size	Key	A	BA	D	E	F	H	U	V
SC 326U	½ x ½	16	5¼	8	6¼	6	21/32	1⅞	5⅜



SPEED-TORQUE curves show how transfer to full winding can be made at higher speed after current has fallen off.

"WE SECURED EVEN TEMPERATURES THROUGHOUT THIS 14-STORY BUILDING WITH SARCOTHERM HEATING SYSTEM CONTROLS,"

say Slingerland and Booss, architects and engineers

New York's "Avon House," completed in 1957. Architects and Engineers: Slingerland and Booss, 120 Greenwich Street, N. Y. C.

Mechanical Contractors: Fein-Schlosberg, Inc., 1770 Second Avenue, N. Y. C. Owner: The Ten Men Realty Co., Leon Finley, President, N. Y. C.

In the superbly appointed "Avon House" apartments at 340 East 74th Street, New York, the complete automatic heating control job is Sarcotherm. The architects and engineers, Slingerland and Booss, called on Sarco's experienced engineering department to work with them and the mechanical contractor in working out components—controls, vacuum pumps and steam specialties. Besides setting up undivided responsibility of one manufacturer, this policy assured a balanced system with no weak links.

Accurate orifice calculations by Sarcotherm insured proper distribution of subatmospheric steam in the system, even in mild weather. Each of the 2 zones of this building is controlled by a Sarcotherm Continuous Flow Modulating Steam Control Valve. These valves meter the steam to furnish proper heat at any given outside temperature. Control Valves are influenced by outside temperature, wind velocity, and solar radiation, plus differential steam pressure between supply and return mains. A Master Control Panel supplies complete programming operation with automatic control for day, night and morning pickup cycles.

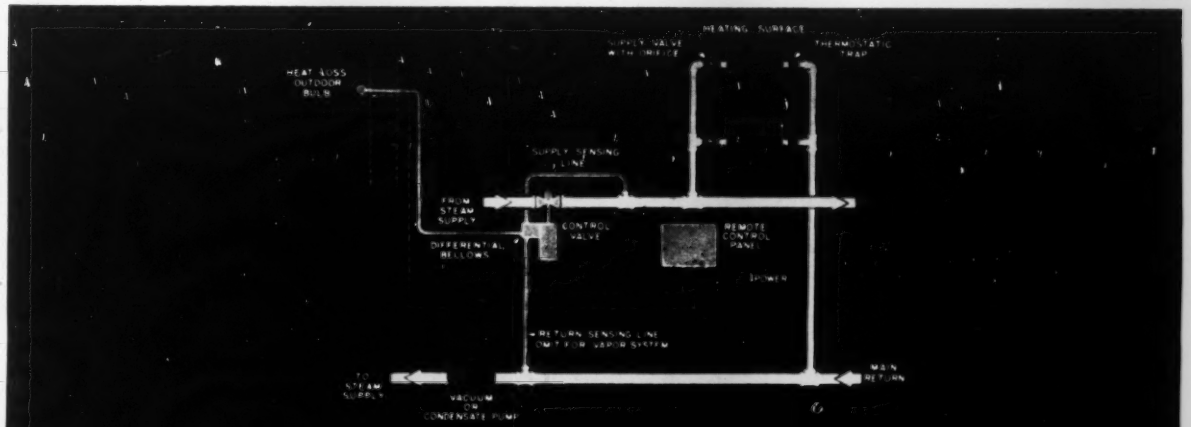
There is ample testimony to the sound judgment of the architects in making this a complete Sarcotherm vacuum heating control system. Since its first day of operation the installation at the new Avon House has been 100% trouble-free.

SARCOTHERM

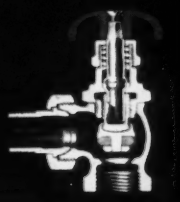
An Affiliate of SARCO Co., Inc.

635 Madison Avenue, New York 22, N. Y.

"INSTALLATION WAS EASY, THANKS TO SARCOTHERM ENGINEERING SERVICE AND UNDIVIDED RESPONSIBILITY FOR CONTROLS, SPECIALTIES, PUMPS," *say Fein-Schlosberg, Inc., mechanical contractors*

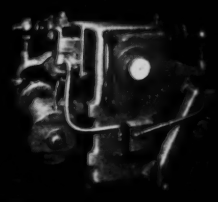


This schematic hook-up shows continuous-flow Sarcotherm System



Sarco No. 1141 Spring Packless Steam Radiator Valves, Type H Radiator Traps and Type FT Float-Thermostatic Steam Traps are used.

This WFA-X6 Control Panel has supply and return pressure gauges.



DVA Duplex Vacuum Pump is furnished complete with magnetic starters, float switch and vacuum regulator.

Marked advantages were found by the mechanical contractors in the quality of orifice engineering provided by Sarcotherm. Every valve, for example, was calibrated and the orifice plate brazed in at the factory. All units were tagged, unit-packaged, and keyed in with the hook-up drawing. The installation was supervised by Sarcotherm engineers. The installation was rapid and easy. No on-the-job adjustments were necessary.

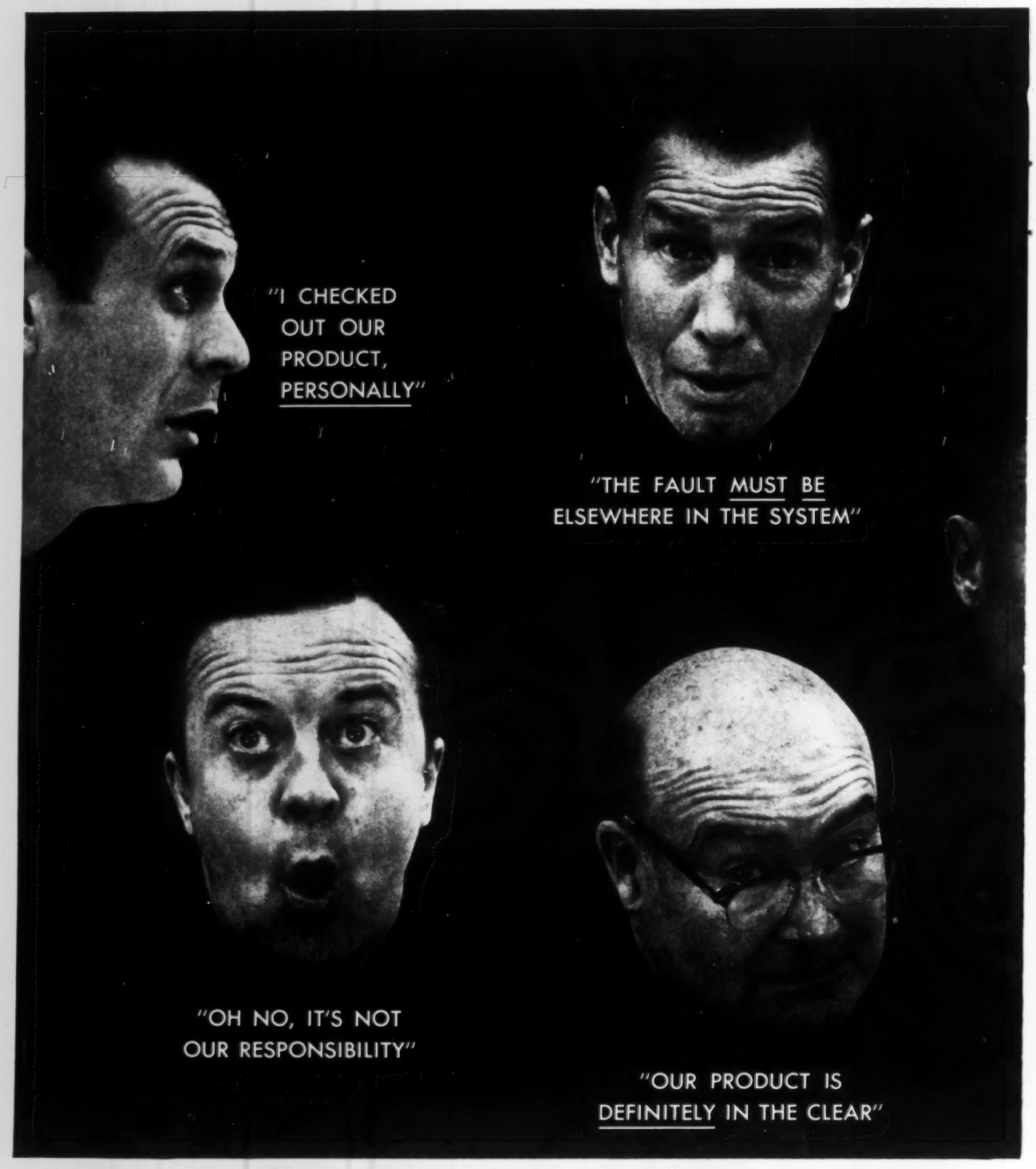
*

FOR COMPLETE CONTROL SYSTEM CATALOG write Sarcotherm Controls, Inc., 635 Madison Ave., New York 22, N. Y.

SARCOTHERM

An Affiliate of SARCO Co., Inc.

6176-B


"I CHECKED OUT OUR PRODUCT, PERSONALLY"
"THE FAULT MUST BE ELSEWHERE IN THE SYSTEM"
"OH NO, IT'S NOT OUR RESPONSIBILITY"
"OUR PRODUCT IS DEFINITELY IN THE CLEAR"

One call for all

CENTRIFUGAL REFRIGERATING MACHINES • CENTRAL-STATION AIR CONDITIONERS
PACKAGED WATER CHILLERS • PACKAGED AIR CONDITIONERS • FANCOIL UNITS
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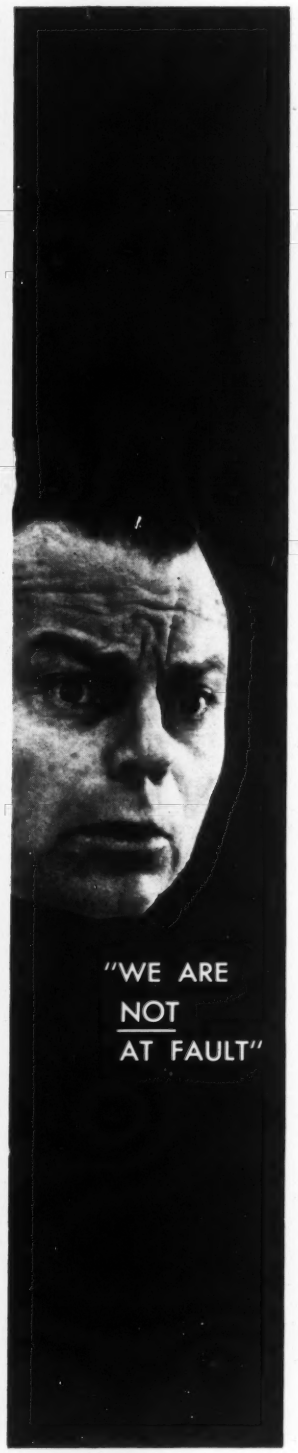


Why divide responsibility for air conditioning equipment?

THERE'S A SAYING that a camel is a horse designed by a committee. Not so. A camel is a horse assembled by a committee. The horse concept is still basically a sound one.

Yet, by the same token, what happens when you split responsibility for the elements in a building or plant air-conditioning, heating, and ventilating system? The components are built by separate manufacturers who are answerable only for what they make.

How much better to select *all* the major components from American-Standard* Industrial Division. You choose from the combined American Blower, Ross Heat Exchanger, and Kewanee Boiler product lines . . . have *one-source* responsibility for quality and performance in equipment designed, engineered, and manufactured to work together.

Offices, in all principal cities, staffed with product specialists, work with you in equipment selection and on-the-job problems. Give the one near you a call. AMERICAN-STANDARD INDUSTRIAL DIVISION, DETROIT 32, MICH. IN CANADA: AMERICAN-STANDARD PRODUCTS (CANADA) LIMITED, TORONTO, ONTARIO.

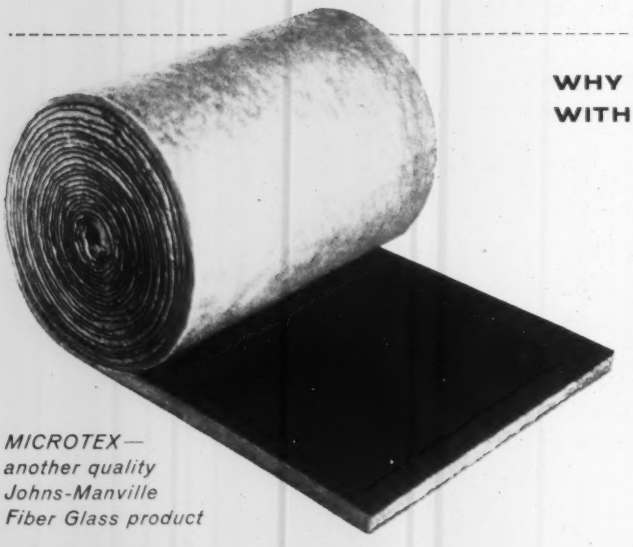
*American-Standard and Standard are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
INDUSTRIAL DIVISION

AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS

Keeps air ducts quiet . . .

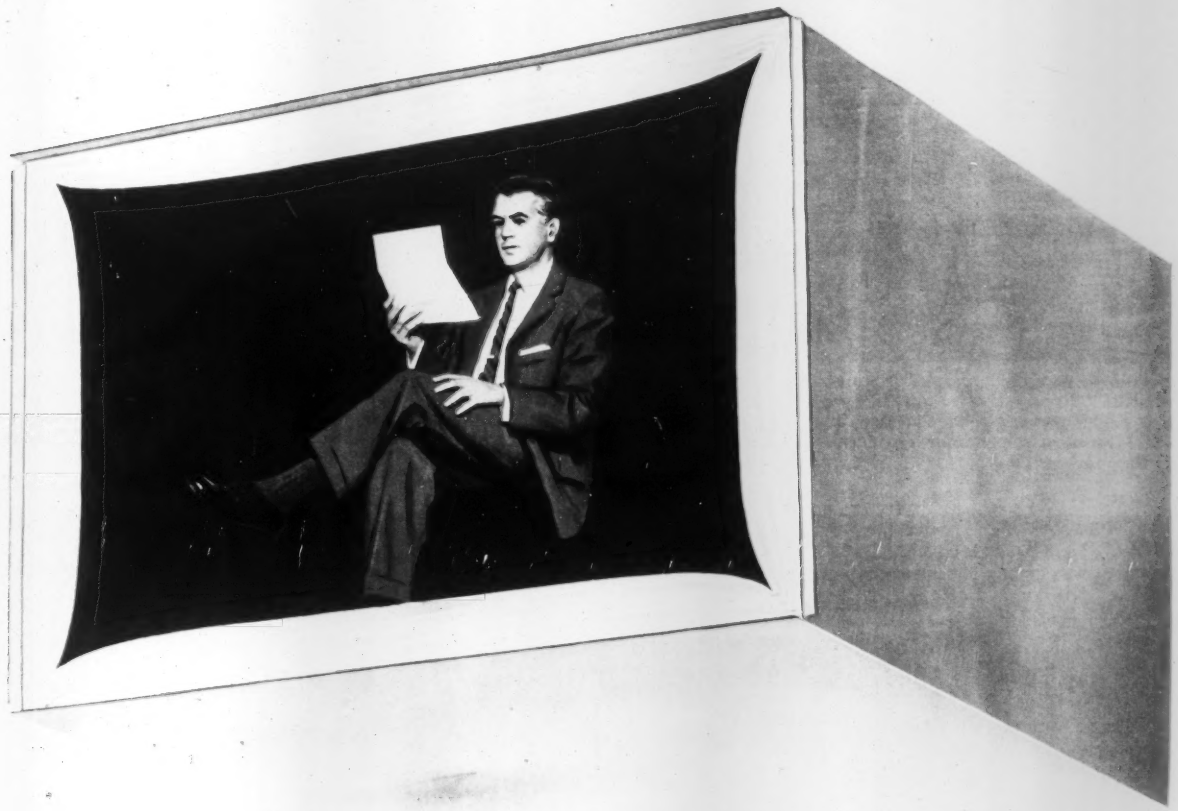
J-M Microtex® fiber glass duct liner does



MICROTEX—
another quality
Johns-Manville
Fiber Glass product

WHY YOUR INSTALLED COSTS ARE LOW WITH JOHNS-MANVILLE MICROTEX . . .

- **LIGHTWEIGHT MATERIAL.** Easy to handle in the shop.
- **RESILIENT.** Can be formed with the metal in the brake.
- **STRONG.** Holds up during shop handling. Won't pull apart. Less waste.
- **EASY TO CUT AND FIT.** Regular shop methods, skills and tools speed fabrication.
- **PLEASANT TO HANDLE.** Workmen like the texture of Microtex.



keeps them efficient, too

both effectively... and at low cost

Thanks to carefully engineered metal air duct systems lined with Johns-Manville Microtex, it's quiet as a country churchyard inside many a modern building. Duct noises from motors, fans and adjacent rooms get into this fiber glass insulation—and never come out again! They're trapped and killed by countless microscopic air pockets formed by the millions of fine glass fibers.

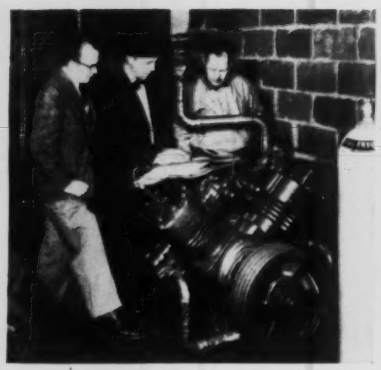
Comfort is increased, too, because temperatures of the cooled or heated air can be more evenly controlled during distribution. This is a result of the high insulating efficiency of Microtex which also reduces power and fuel costs.

Johns-Manville Microtex is a semi-rigid blanket. The fine glass fibers are reinforced with textile yarn and bonded with a thermosetting resin. A black vinyl coating resists erosion even at top air velocities . . . eliminates need for painting inside of ducts in back of grills. Furthermore, with the insulation inside the duct, the sheet metal itself serves as the vapor barrier.

Over-all, Microtex provides maximum insulation value for dollar invested. It reduces installation costs—*see opposite page*. Its inorganic glass fibers are ageless . . . no danger of loss from rot, decay, moisture or vermin.

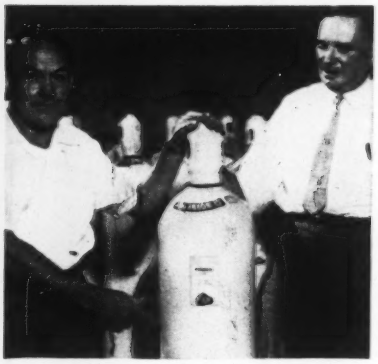
For specification and installation data on high-efficiency, low-cost Microtex, contact your nearby Johns-Manville representative. Or write to Johns-Manville, Box 14, N. Y. 16, N. Y. In Canada, Port Credit, Ont.

JOHNS-MANVILLE JOHNS-MANVILLE JM PRODUCTS



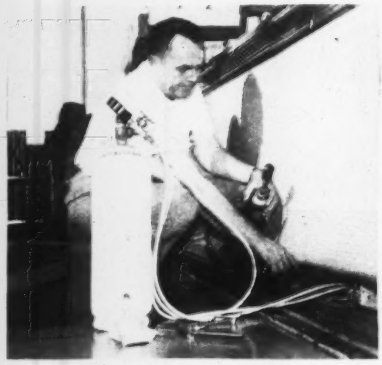
Baltimore, Maryland, service engineer reports: "'Freon' refrigerants help us do a better servicing job. It's dry and safe—the most dependable refrigerant on the market today."

East Rockaway, New York, contractor reports: "Nothing works like 'Freon'. I'm convinced it's the best refrigerant on the market—safe and dependable for any job."



Louisville, Kentucky, service man reports: "'Freon' is the world's best refrigerant for our money. It's pure, dry and safe—never causes one bit of worry or trouble."

Atlanta, Georgia, contractor reports: "We've never had a bad batch of 'Freon' in the 25 years we've used it. It's never caused us trouble on the job or—after years of service—in a system."



Tucson, Arizona, service man reports: "'Freon' refrigerants help us do the best job possible. They're reliable and safe. Since 'Freon' came out, we've never used anything else."

St. Louis, Missouri, service man reports: "We've never had a moisture or corrosion problem in equipment charged with 'Freon.' It's absolutely dependable—always pure and dry."

All over the country, users are talking about the advantages of Freon* refrigerants

East, west, north or south—contractors and service men appreciate the extra quality of "Freon" refrigerants that costs them nothing extra.

"Freon" is today's premium-quality refrigerant . . . stable, pure, dry—nonflammable, nonexplosive, nontoxic. It's time-tested—in use over 27 years and made only by Du Pont—backed by years of technical and manufacturing leadership.

Specify "Freon" refrigerants for every refrigerant need. Your Du Pont wholesaler has it—now capped in gold and factory-sealed to guard its purity till you're ready to use it.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING ... THROUGH CHEMISTRY

FREON® *premium quality* **REFRIGERANTS**

**Freon and combinations of Freon- or F- with numerals are Du Pont's registered trademarks for its fluorinated hydrocarbon refrigerants.*

**Heating
Piping &
Air Conditioning**

September 1959

You'll Want To Know...

For news of new products, see the Equipment Developments department in this issue, and for new catalogs, bulletins, etc., see the Recent Trade Literature columns. Other news material also appears in the Who's What and the We Hear That departments. Meetings and Conventions are listed toward the back of this issue under that title, as are New Books and Reports.

PIPEFITTER APPRENTICE CONTEST WINNERS congratulated here by John J. McCartin, UA assistant general president. First place went to Robert W. Forster, Cleveland, left; Frank E. Davis, Johnstown, Pa., second; and George F. Riebe, Milwaukee, third

Pipefitter Apprentices Vie In Annual Contest at Purdue

NEW SKILLS required in fabricating modern piping systems of today are being encouraged by the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry each year through its annual apprentice contest at Purdue University.

The sixth such contest was held August 10 to 14, in which 12 pipefitter apprentices participated. Winners were:

First — Robert W. Forster, Cleveland, Local Union No. 120, with a score of 1786, who received the top cash award of $1000.

Second — Frank E. Davis, Johnstown, Pa., Local Union No. 420, with a score of 1762, who received a cash award of $500.

Third — George F. Riebe, Milwaukee, Local Union No. 601, with a score of 1726, who received a cash award of $250.

For the first time this year a separate contest was held for sprinkler pipefitters and there were nine apprentices participating. The winners of this contest were:

First — Charles D. Tillman, Jr., Clay, N. Y., Local Union No. 669, with a score of 80.9, who received the top cash award of $1000.

Second — James Galbraith, Milwaukee, Local Union No. 183, with a score of 80.6, who received a cash award of $500.

Third — Armand Malenfant, Detroit, Local Union No. 704, with a score of 78.3, who received a cash award of $250.

In competition, the apprentice contestants, all winners of their local state contests, are put through a vigorous series of tests to determine their basic knowledge and skills of pipefitting. One half of the score made by the contestants is based on written tests, while performance tests make up the other half.

Concurrent with the contest was an instructor training course, which is held each year at Purdue, in which 327 apprentice instructors from 36 states, Nova Scotia, the Canal Zone, and four Canadian provinces participated. A report of this apprentice instructor training program is on pages 91 through 93 of this issue.

This apprentice training program is sponsored by the UA on the international level and by the local unions on the state and local levels. The Mechanical Contractors Association of America works with the UA very closely in this program through the National Joint Pipefitter Apprenticeship Committee and through the many members who are employers. As William Scott, president of the Mechanical Contractors Association of America, stated, this apprentice training program is the best example of cooperation between labor and management.

Peter T. Schoemann, general president of the UA, told the contestants that the apprentice training program being conducted today in over 760 local unions is one of the most important things that the UA is doing. He reported that progress is being made and the results of the program now are beginning to be evident through the young journeymen who have received their apprentice training in recent years. He said that many men who won their state apprentice contests and those that went on to win recognition in the national contest at Purdue in the last few years now hold responsible positions in their local communities. The quality of apprentice training given to these men is paying off, he said, and much credit is being brought to the UA through this exhibition of skills acquired in this training program.

Mr. Schoemann stated that this apprentice training program must succeed if the pipefitter is to retain his position in the industry. It is essential that he be skilled and versatile to perform for his employer in the manner that is in keeping with the present competitive situation.

It is also most important for the journeymen to keep up with new developments and new installation practices, he pointed out.

To assist in the execution of this training program for apprentices and journeymen, the International Training Fund was originated in 1956 for use by the entire UA membership. The administrator of this fund, James P. Schoemann, outlined the objectives and reported on what is being done. The fund is made up from assessments on each employer at the rate of 2½ cents for each hour that each UA journeyman is employed. A Board of Trustees consisting of five UA members and five mechanical contractor employers actually administers the fund through the direction of James P. Schoemann.

Three main objectives which this fund fulfills are:

1) To aid in the training of all apprentices of the UA,
2) To provide training funds for local unions and in areas that are more in need of assistance than others,
3) To assist in training journeymen in new techniques and developments in order for them to retain their skills.

The seventh annual UA apprentice contest and instructors training course will be conducted next year on August 15 through 19, again at Purdue.

You'll Want To Know

L.A. Air Conditioning Conference To Include "Engineer's and Contractor's Days"

A SPECIAL SERIES of clinics, sessions, and seminars is scheduled for the 3rd Western Air Conditioning, Heating, Ventilating, and Refrigeration Exhibit and Conference. The Conference, is to be held April 27-30, 1960 in Shrine Exposition Hall, Los Angeles, will present technical, semi-technical and general interest meetings.

An "Engineers' Day" will include a clinic for junior engineers on fan auxiliary equipment, emphasizing selection of fan drives, electric motors, motor starters, and vibration control. Senior engineers will attend a conference on specification writing.

"Contractors' Day" will have a technical session on connections for steam and hot water boilers, a sheet metal contractors' session on high velocity systems, an air conditioning contractors' clinic on temperature control systems.

on condensing methods.

"Journeyman's Day" will feature four sessions:

1) Piping men on piping
2) Sheet metal men on testing and balancing
3) Power engineers on condenser and boiler maintenance
4) Refrigeration men on defrosting methods.

Four other meetings of more general public interest have also been scheduled, including:

1) Hospitals — control of air borne infections
2) Schools — what not to do in preparing for future air conditioning
3) Office structures — lighting load versus air conditioning
4) Hotels — ventilation's importance as a part of air conditioning.

New Church Installs Air Conditioning

THE CONGREGATIONAL Christian Church of Fairfax County, Virginia, is among at least seven other churches in the area to be air conditioned at the time of construction by the heat pump method, according to Carrier Corp.

The church heating system gives good zone control, permitting economical heating or cooling of meeting rooms, kitchen or pastoral offices at times when the entire building is not in use. Equipment is located along the wall of an interior court of the church building. Nine of the 10 indoor sections are stacked in a central equipment room occupying 285 sq ft of floor space and 24 ft of exterior wall.

Piping Gives Airport Hangar Double Winterizing Protection

DOUBLE PROTECTION, in the form of radiant heating and snow melting systems, has been designed into Mohawk Airlines' new headquarters plant at Oneida County Airport, N.Y., according to A. M. Byers Co.

The two new 300 × 120 ft hangars required radiant heating to help restore the indoor temperature quickly when hangar doors are opened and then closed, to provide a more comfortable and less drafty working area, and help to keep the hangar doors dry by speeding water evaporation as snow melts from aircraft.

The snow melting system is designed to eliminate ice and snow from blocking or drifting against the main hangar door.

Each system supplements the other in preventing hangar doors from freezing tight or jamming.

MCAA Appoints Ryan Executive Secretary

THOMAS J. RYAN was named executive secretary of the Mechanical Contractors Association of America, Inc. effective August 1, 1959. His office is at the Association's national headquarters, 45 Rockefeller Plaza, New York 20.

Mr. Ryan is a former special assistant to the General Counsel of the National Labor Relations Board where he was chairman of the General Counsel's Advisory Committee.

AGA Nominates Officers; Annual Meeting Oct. 5-7

WISTER H. LIGON, president and director of the Nashville Gas Co., Nashville, Tenn., has been nominated for the presidency of the American Gas Association. He is currently first vice president. Other nominees include:

First vice president: L. T. Potter, Lone Star Gas Co., Dallas.

(Continued on p. 524

You'll Want To Know

Second vice president: E. H. Smoker, president, United Gas Improvement Co., Philadelphia.

Treasurer: Vincent T. Miles, treasurer, Long Island Lighting Co., Mineola, N.Y.

Also nominated were 15 directors, in addition to 10 chairmen and vice chairmen of the Association's accounting, general management, industrial and commercial gas, and residential gas sections.

Elections will be held on Oct. 7 at the national gas industry trade association's 41st annual convention in Chicago.

Panel Cooling, Heating Goes Into New Building

THE NEW 28-story Kaiser Center office building in Oakland, Calif., will contain more than 300 miles of steel pipe as part of its air conditioning system. Through these pipes, more than 5 million gal of water will circulate daily.

Heating and cooling systems will be in constant operation. Chilled water will by supplied from a 2500 ton refrigeration system with heated water being furnished by three boilers delivering 12,500 lb of steam per hr.

Pipe in the system will range in size from 1½ in. galvanized pipe to 20 in. black pipe. The larger sizes of pipe will be used to distribute the water vertically in the building. The smaller pipe is employed in the fabrication of the grids.

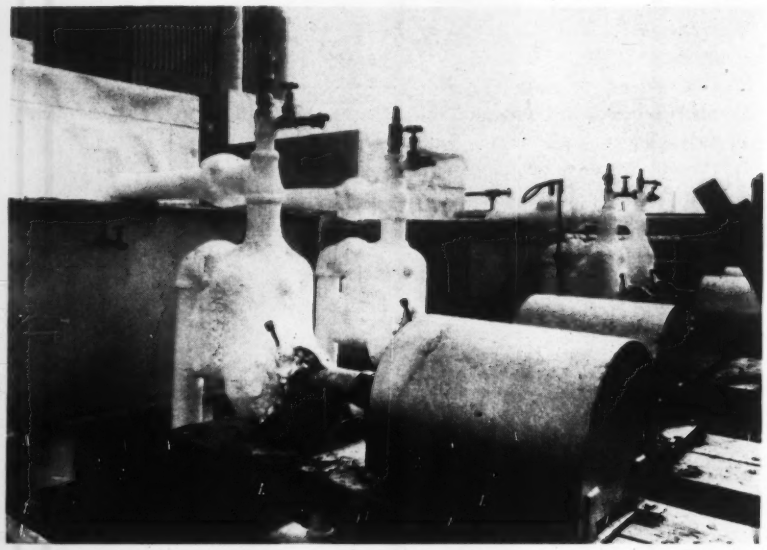
About 110 galvanized pipe grids are required for each floor. Each grid consists of two parallel 1¼ in. "headers" about 14 ft apart with a series of 12 to 15 half-inch pipe sections between the headers.

The structure is scheduled for completion by the end of this year.

Basic units in the heat exchange system are more than 3000 pipe grids, suspended from the ceiling of each level of the 390 ft high building, biggest in the west.

Perforated metal acoustical tiles will be attached below these grids forming the visual ceiling. The tiles will be heated or cooled by the grids. The tiles then control the temperature of the room by heating or cooling it by radiation, according to the Kaiser Steel Corp.

You'll Want To Know



Refrigerant Piping Keeps Ice Cream Bars "Real Cool"

FOUR self-priming centrifugal pumps help the Good Humor Corp. to produce its familiar ice cream bars. These pumps, located on the roof of its Brooklyn, N.Y. plant, circulate brine in 3 in. standard galvanized piping through the shell and tube brine cooler supplying refrigeration to the four automatic freezing and processing machines.

The pumps operate 24 hours a day, having total capacity of 1000 gpm.

Outside, alongside the building is a turbine pump supplying cooling water for the ammonia condensers, ice cream mix, and water for other cooler and compresser water jackets.

The piping joints for the pumps are flanged unions, two each on the suction and discharge with one directly attached to the underside of the processing machine below floor level, as well as one on the roof at the pump itself.

All piping below floor level and risers in the wall channel are covered with 4 in. cork insulation. Vertical piping is supported at the roof and below floor levels with wooden cradles, according to the Deming Co.

All valves are of the screwed type. Each suction line has a swing check valve and a gate valve installed and each discharge has a gate valve.

Industrial Construction Gains Predicted

THE SHARP step-up in preliminary engineering activity for new plants within recent weeks indicates that industrial construction this year will be even greater than surveys have indicated, according to C. B. Wigton, president of Wigton-Abbott Corp.

Mr. Wigton stated that, "The two basic reasons for this revival of expansion activity are the awareness on the part of industry for the need of up-to-date production facilities and the realization that delay may mean incurring additional costs in a rising labor and materials market."

". . . In addition to the resurgent national economy, extra impetus for encouraging new plant construction is coming from the large number of new products which have been in the research laboratory and pilot plant stage for the past few years and which are now ready to be put on the market."

"...Contracts for industrial structure through the first six months of this year exceeded $1.3 billion, a gain of 37 percent over last year."

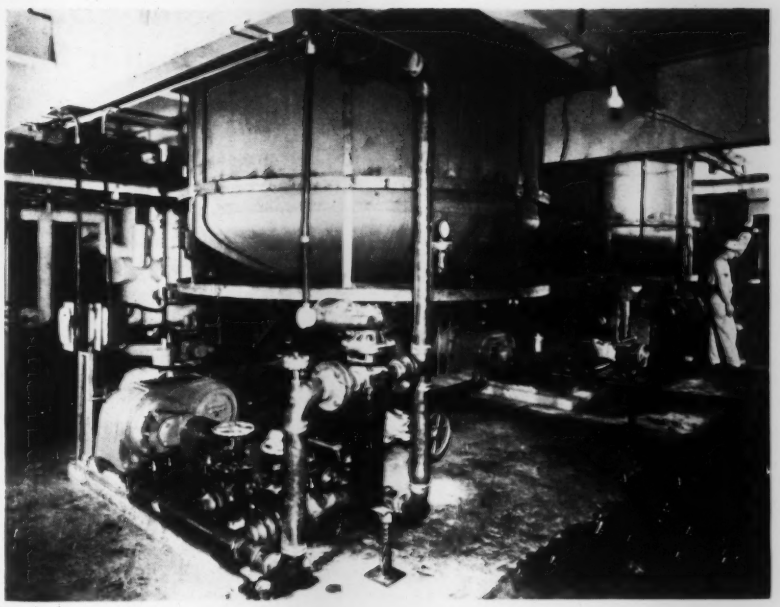
ARI Figures Show Gains In Central Air Conditioning

THE INSTALLED COST of central-station air conditioning rose to an estimated $550,730,000 during 1958. According to the Air Conditioning and Refrigeration Systems Section of the Air-Conditioning and Refrigeration Institute, this figure represents the installed value of equipment in place, rather than the value of manufacturers' shipments, which would be considerably below the installed value figure.

More than 95 percent of all the central station air conditioning systems in the country are produced by manufacturers making up the Systems Section of ARI. They state that about half of the 1958 volume was installed in multi-room buildings and the other half was divided equally between commercial and industrial establishments, although less than 10 percent of U.S. factories, plants and industrial installations now have air conditioning.

Based on ARI figures, the installed value of systems put into operation since 1950 has been:

1950	$241,770,000
1951	278,200,000
1952	252,920,000
1953	295,040,000
1954	378,810,000
1955	434,120,000
1956	528,180,000
1957	598,900,000
1958	550,730,000



Grease Piping System Requires Precision Welding

A RECENT MODERNIZATION program for handling the packaging of greases at Esso Standard Oil Co.'s Pittsburgh plant depended to a large extent upon careful pipe fabrication and precision welding of 3 in. diam pipe joints, according to Blaw-Knox Co.

Basically, a piping system was installed to handle various kinds of grease products from each of the cooking kettles to a pipe jump-over panel board. This allows the operator to direct the grease through various types of production machinery, to storage tanks, and to a central container filling area.

A wide variety of greases are pumped in the same pipeline, making it necessary to clean the line between product runs to prevent contamination and minimize waste. This clean-out operation is performed by forcing a neoprene ball, called a "pig", through the pipeline with compressed air.

The piping system requires a smooth inner surface, particularly at the joints. This meant precision welding producing a 100 percent joint penetration with no inner snags or projections. Back-up rings were employed in welding as many of the joints as possible.

Over 3000 ft of 3 in. diam piping went into this system.

You'll Want To Know

Chase Manhattan Bank Cooling Capacity Leader

NEW YORK CITY'S new 60-story Chase Manhattan Bank Building has received the largest single piece of air conditioning equipment ever built, according to Carrier Corp.

Included in the 10 day lifting job to an 11th floor machinery area of the building was a 70,000 lb refrigerating machine—one of 14 pieces of component apparatus, which weigh 327,930 lb. Assembled, the unit will be 2 ft long, and 15 ft high, with a flow of water at the rate of 18,000 gpm.

The cooling capacity of 9140 tons, will be obtained through use of four refrigeration machines. As a result, the Chase Manhattan Bank Building will have the largest cooling capacity of any commercial building, surpassing the previous record of the Merchandise Mart in Chicago. It is exceeded only by the Pentagon.

Construction Contracts Set All-Time Record

CONSTRUCTION CONTRACTS in the first half of 1959 set a new all-time record for the period. Large increases in residential and non-residential building categories offsetting declines in heavy engineering were noted, according to F. W. Dodge Corp.

Total contracts for the first six months of this year reached $18.9 billion, 12 percent ahead of the same period last year — non-residential contracts were $5.7 billion, up 4 percent — residential contracts totaled $8.9 billion, up 37 percent — heavy engineering contracts were $4.3 billion, down 11 percent.

You'll Want To Know

Inspect Safety Devices Regularly To Avoid Boiler Explosions

WHAT CAUSES a boiler to explode? . . . excessive pressure. The steam or water pressure suddenly becomes higher than that for which the boiler was built. According to Edward J. Benesch, vice president and chief engineer with Syska & Hennessy, consulting engineers, the only thing required to eliminate them is reasonable care and periodic inspection of the safety devices.

On the other hand, oil or gas explosions are caused by the ignition of an accumulation of oil vapor or gas in the presence of air. A leaky gas valve, even though the leak is ever so slight, can allow sufficient gas, particularly during the off-heating season, to enter and accumulate in the furnace so that when ignition does take place, an explosion follows. With oil, the burner may drip a slight amount into the furnace after it has stopped, the oil will vaporize and the vapor accumulates, so that when ignition takes place an explosion takes place too.

What is done to guard against delayed ignition? In commercial boilers, a photo cell type of control "sees" the main flame and a detector is provided for the gas pilot flame, which is employed to ignite the oil-air mixture. The burner will not start should the pilot flame be out or not of the right size to ignite the oil or gas properly. Another safety cycle is included in burner operation for package type boilers: After the burner shuts off, the draft fan continues to operate for a predetermined period of time to purge the boiler of any unburned gases; and again, before the burner starts, the purge cycle takes place.

However, Mr. Benesch warned that automatic controls and burners must be inspected and maintained in proper working condition to operate safely.

Offer Tech Writing Correspondence Course

A NEW correspondence course is being offered in scientific and technical writing by the University of California Extension Service at Berkeley.

Further information and application for enrollment can be obtained from the Department of Correspondence Instruction, University of California Extension, Berkeley 4, Calif.

ASME Publishes New Gas Piping Standard Code

THE LATEST EDITION of American Standard Code for Gas Transmission and Distribution Piping Systems, ASA B31.8-1958, has been approved by the American Standards Association and published by the American Society of Mechanical Engineers.

This code is Section 8 of the American Standard Code for Pressure Piping. Section 8 covers minimum requirements for the design, fabrication, installation, inspection, testing, and safe operation and maintenance of gas transmission and distribution systems. The Code for Pressure Piping deals primarily with engineering requirements for safe design and construction of piping systems.

Copies of the new code may be obtained for $2.50 from the Order Department, The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N.Y. Other sections of the Code are also available from the ASME.

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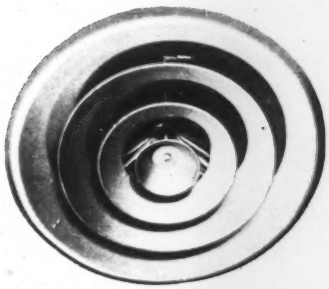
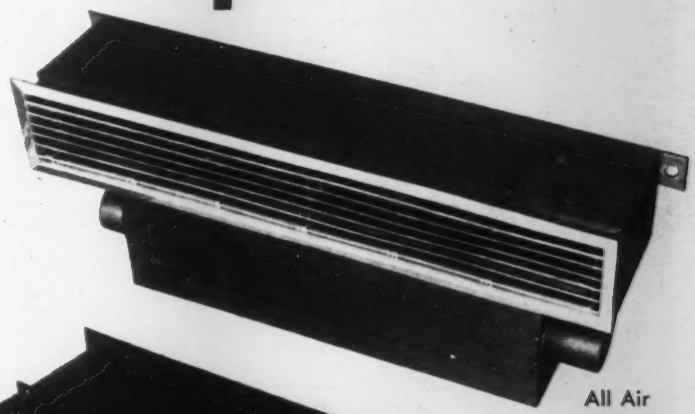
is a registered trademark for a wide range of air diffusion equipment

Today Anemostat offers an impressive variety of air diffusion equipment to meet every architectural and engineering requirement. ANEMOSTAT® is a registered trademark. It is your guarantee that every unit bearing this name is of highest quality . . . backed by the most experienced engineering, research and testing laboratories in the industry.

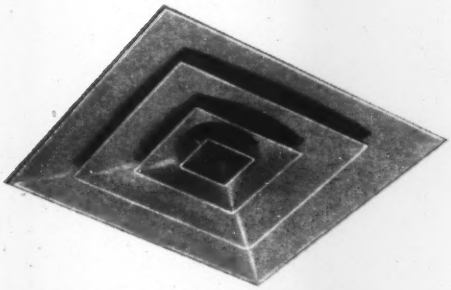
When Anemostat Air Diffusers are in sight the system is right. This was true yesterday, is true today and will be true tomorrow.



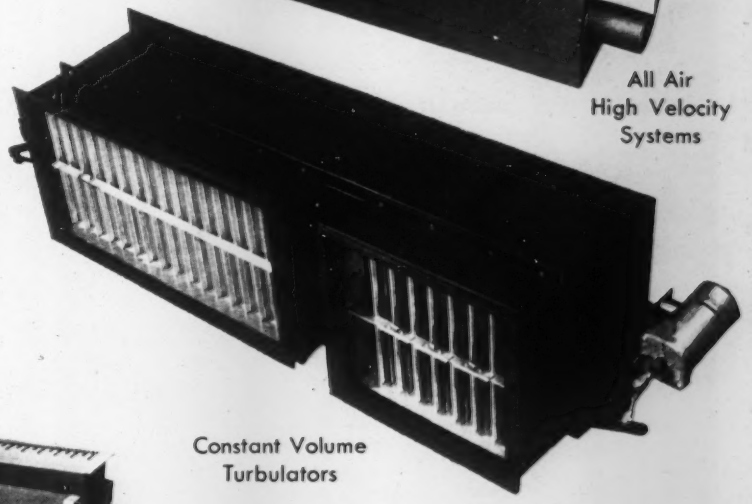
Conventional Air Diffusers



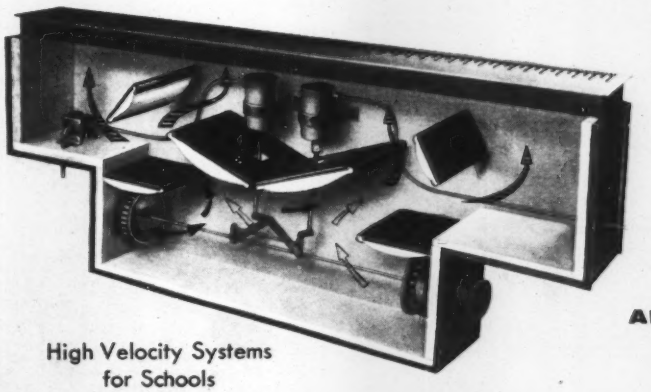
All Air High Velocity Systems



100% Induction Air Diffusers



Constant Volume Turbulators



High Velocity Systems for Schools

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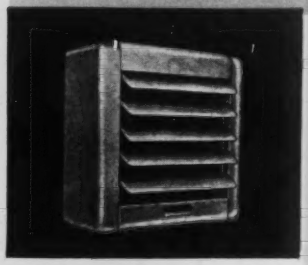
"No Air Conditioning System Is Better Than Its Air Distribution"

Speaking of FLEXIBILITY...

UNIVAC® computer confirms

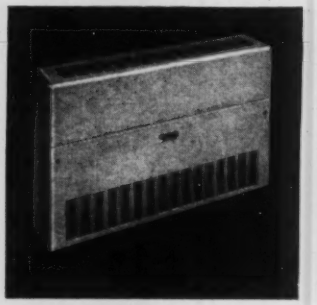
Can you think of a need that calls for a unit heater — steam, hot water, gas, or electric — which can not be met by one of these Nesbitt units? If you do, let us know; we may add to our line. Meanwhile, with more than 40 years of proved excellence in *this* line, why not make Nesbitt your name to go buy?

STEAM & HOT WATER



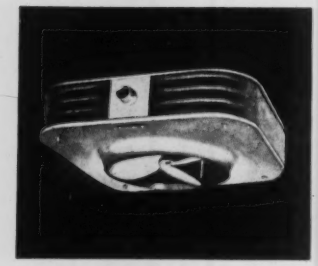
1,084 ways to employ Nesbitt Propeller Fan Heaters

Eight basic sizes, 24 models; universal heating elements for steam or hot water; capacities, 15,200 to 335,000 Btu/hr; sound code rated—*Publication 401.*



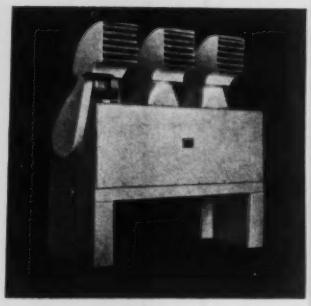
6,510 ways to employ Nesbitt Cabinet Unit Heaters

Series A: versatile high-capacity units; seven basic sizes (265 to 1860 cfm) for steam (71 to 545 sq. ft. edr) or hot water (9.1 to 120 mbh); recessed, semi-recessed, or non-recessed models; floor, wall, ceiling and inverted mountings—*Publication 403.*



5,170 ways to employ Nesbitt Little Giant Heaters

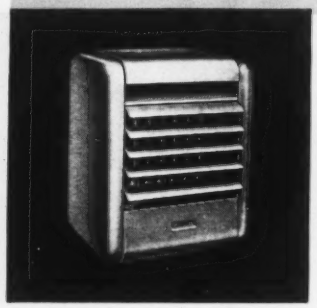
Draw-through propeller fan units with universal heating elements for steam or hot water; 14 sizes, 34 models; 16,000 to 610,000 Btu/hr; wide choice of vertical or horizontal discharge outlets; sound code rated—*Publication 402.*



22,800 ways to employ Nesbitt Giant Unit Heaters

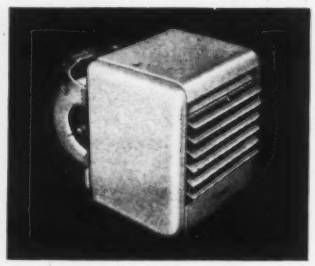
For large capacity heating and/or ventilating, free or static delivery; 12 basic sizes each with choice of 10 heating elements; steam or hot water; 83,000 to 1,735,000 Btu/hr; one to three fans; four mountings—*Publication 404.*

GAS-FIRED UNITS



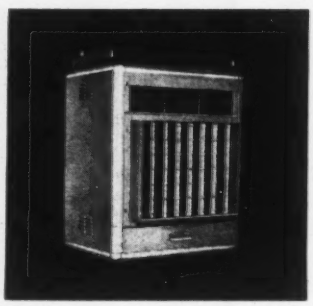
200 ways to employ Nesbitt Propeller Fan Heaters

Lightweight and more compact, the new Series K gas-fired unit heater is versatile and attractive. 25,000 to 250,000 Btu/hr input. Sound code rated—*Publication 400.*



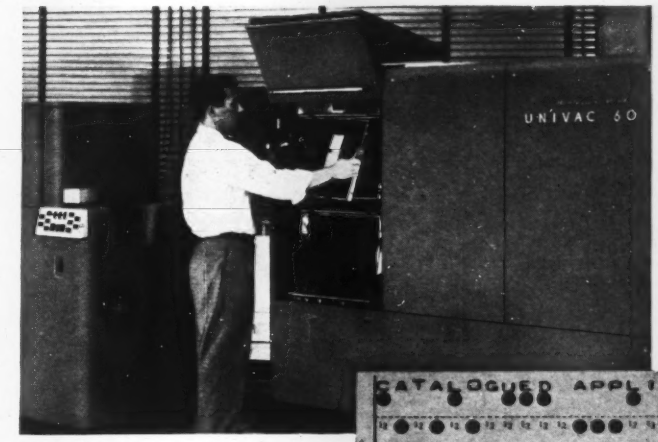
240 ways to employ Nesbitt Blower Fan Heaters

For extreme quietness, free delivery or use with ducts. Eight basic sizes, 50,000 to 250,000 Btu/hr input; universally approved for all types of gas; standard horizontal or (optional) double deflection louvers —*Publication 400-2.*



30 ways to employ Nesbitt Gas-fired Duct Furnaces

Efficient, automatic gas heating for use with air-conditioning units or with custom ductwork in heating and processing. Six basic sizes, 80,000 to 250,000 Btu/hr input; aluminized steel or stainless steel heat exchanger—*Publication 400-3.*



that there are

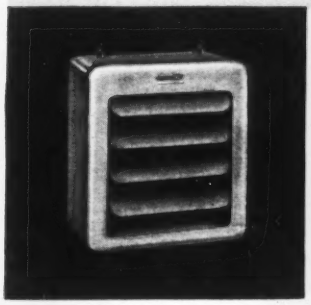
38,852 ways to employ the Nesbitt complete line of UNIT HEATERS

Fantastic? Not at all! Considering all the basic sizes, installation arrangements, types and capacities of heating elements, fan speeds, and discharge outlets, there are actually 38,852 catalogued situations in which at least one of the broad line of Nesbitt Unit Heaters will meet the demands with complete satisfaction. What more could you ask?

Made by* John J. Nesbitt, Inc., Philadelphia 36, Pa.—Basic Ingredient: *Excellence

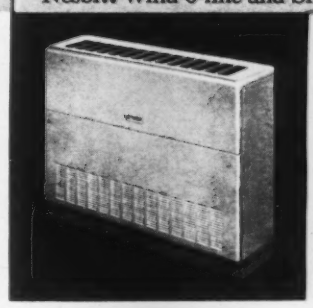
ELECTRIC UNITS

Also available in electric: Nesbitt Syncretizer and Thermovent heating and ventilating units; Nesbitt Wind-o-line and Sill-line radiation.



28 ways to employ Nesbitt Propeller Fan Heaters

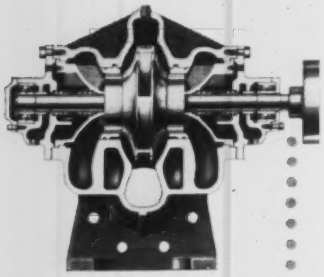
Fast and efficient heat, automatic or manual control; in four basic sizes, 14 models; capacities from 5,118 to 122,832 Btu; replaceable black-heat elements; totally enclosed motors; quiet Q-type fans—*Publication E401.*



2,790 ways to employ Nesbitt Electric Cabinet Heaters

Three basic sizes, 10 models; 3.3 to 30 kw, 11.4 to 102.4 mbh; recessed, semi- and non-recessed models; floor, ceiling, wall, or inverted mounting; manual or automatic control; two or more fans; sound code rated—*Publication E403.*

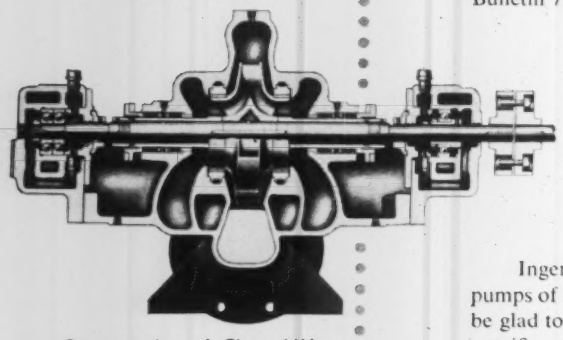
for DEPENDABILITY plus ECONOMY
...IN GENERAL PUMPING SERVICE



Cross section of Maintenance-Free class DMV and DHV pump with double mechanical shaft seals and prelubricated sealed bearings.

I-R Single-Stage, Horizontally-Split Centrifugal Pumps offer many features for trouble-free performance and low operating and maintenance costs

For capacities from 250 to 2400 gpm and heads to 350 ft., the DMV and DHV Pumps shown at the left provide important savings in floor space and virtual immunity to stuffing-box and lubrication problems. All units are equipped with double mechanical shaft seals that eliminate stuffing-box maintenance and pre-lubricated sealed ball bearings that require no attention or lubrication for the life of the pump. For complete details, send for Bulletin 7248-A.



Cross section of Class ALV single-stage pump with conventional stuffing-boxes and shaft bearings.

The standard line of I-R single-stage, horizontally-split pumps, of which the Class ALV unit illustrated is typical, covers the broad operating range from 25 to 50,000 gpm and heads from 20 to 350 ft. Extra-deep stuffing-boxes are equipped with seal cages for the supply of sealing liquid from pump discharge passage or an external source. Two-piece split glands are easy to remove and replace for repacking the box. All of these pumps can be provided with any desired type of drive.

Ingersoll-Rand also offers a complete line of single- and multi-stage pumps of both the horizontal and vertical type. Your I-R representative will be glad to give you complete information on the pumps best suited to your specific requirements.

...IN FIRE PUMP SERVICE

I-R Fire Pumps have been completely approved by the National Board of Fire Underwriters and the Associated Factory Mutual Fire Insurance Companies

External view of a 5FUV Fire Pump equipped with grease-lubricated ball bearings and fire fittings.

Except for details of pump fittings, I-R Horizontal Fire Pumps are identical to the general-purpose units shown above. Fully approved for permanent installations of the hose line or sprinkler type, they provide dependable fire protection for public buildings, small cities, factories, shipyards, hotels and mines.

I-R Horizontal Fire Pumps are available, with any desired standard fire fittings, in capacities of 750 and 1000 gpm at 100 and 125 psi, or 1500 and 2000 gpm at 100 psi. Vertical Units are also available for 750 and 1000 gpm at 100, 125 and 150 psi. Send for Bulletin 7226.

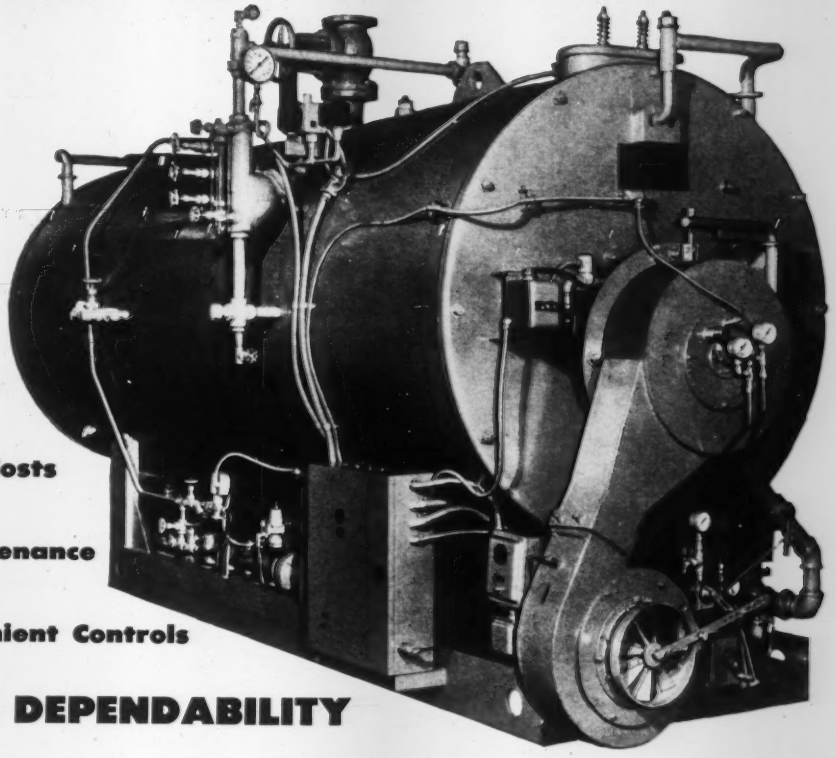
Ingersoll-Rand

10-453 11 BROADWAY, NEW YORK 4, N. Y.

PUMPS • CONDENSERS • COMPRESSORS • DIESEL ENGINES • AIR AND ELECTRIC TOOLS • VACUUM EQUIPMENT

NEW AMESTEAM GENERATOR

MODEL AA



NEW Lower Cost

NEW Oil Burner

NEW Gas Burner

NEW Compactness

NEW Lower Fuel Costs

NEW Lower Maintenance Costs

NEW More Convenient Controls

. . . OLD AMES DEPENDABILITY

The **NEW** Model AA AMESTEAM GENERATOR offers the ultimate in steam generating efficiency and reliability.

The **NEW**ly designed low pressure air atomizing oil burner will cleanly and uniformly burn all commercial grades of oil — #4 with little or no preheat — for more efficient, economical firing. Since electric pumping and preheat loads are lower, power costs are greatly reduced. For gas firing the **NEW** ring type burner provides a more uniform flame pattern for cleaner, more efficient combustion.

All Model AA AMESTEAM GENERATORS are designed to operate at top efficiency over a modulation range of 20% to 100% of rating.

The Model AA incorporates Ames' time-proven 3-pass concentric tube design, single one-piece baffle and one-piece flue covers. Easier access is provided for inspection and servicing. The **NEW** ultra-compact design simplifies positioning and installation. All units are factory-assembled and fire-tested.

Before you buy a package boiler get the facts on the all **NEW** Model AA AMESTEAM GENERATOR.

AMES IRON WORKS, INC.
OSWEGO, NEW YORK

Please send me full details on the **NEW** AMESTEAM GENERATOR, Model AA Package Boiler.

NAME & TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Announcing

A COMPLETE NEW LINE OF

SHAFCONAIRE

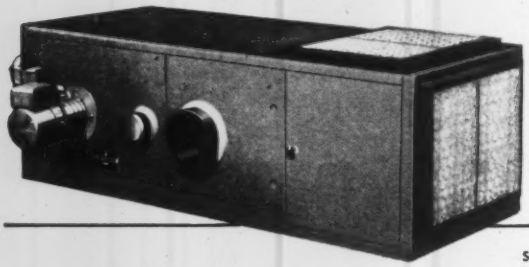
SUSPENDED *GAS FIRED* FURNACES

priced to give you a competitive advantage in the commercial and industrial heating markets!

Another "*First*" for Shafconaire! A new line of suspended gas-fired furnaces designed *right* built *right* for commercial-industrial use—and *priced right*, too, to give you profitable, volume sales! For these new Shafconaires actually cost less than any other type of gas heating equipment of equal capacity on the market today. What's more, they're covered by all required approvals for immediate installation.

4 OUTSTANDING FEATURES for Profitable Volume Sales

- **Power Burner**—provides closer control of gases through heat exchanger—gives greater heating efficiency and lower heating costs.
- **Large Capacity**—designed to handle greater volume of warm air at higher velocity—can be easily connected to duct work to provide controlled distribution of heat.
- **Maximum Head Room**—approved for installation two inches from combustible materials, compactly designed to assure greater clearance.
- **Versatility**—quickly, easily adapted in the field for right hand or left hand installation.



AVAILABLE IN 6 BASIC MODELS TO GIVE YOU BROAD MARKET COVERAGE

85,000 — 97,000 — 112,000 — 142,000 — 182,000 — 252,000 BTU Output

In addition to these six basic models, Shafconaire Gas-Fired Furnaces can also be supplied for duct heater applications. All models are furnished complete with power burner, blower, controls and with or without filters as desired.

SHAFCONAIRE—*the Specified Line for '59!* More national chain organizations have specified Shafconaire this year than ever before. So get your share of this profitable "pre-sold" volume—send coupon today for specifications and prices on the entire line of Shafconaire Suspended Furnaces.

OverHead Heaters, Inc.

Executive Offices: 1612 Book Bldg. • Detroit 26, Mich. • WO 2-4647
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20 years exclusive experience in the design and manufacture of suspended heating equipment

OVERHEAD HEATERS, INC. • 1612 Book Bldg. • Detroit 26, Michigan

Please send complete specifications and price information on your entire line of Shafconaire Suspended Gas-Fired and Oil-Fired Furnaces.

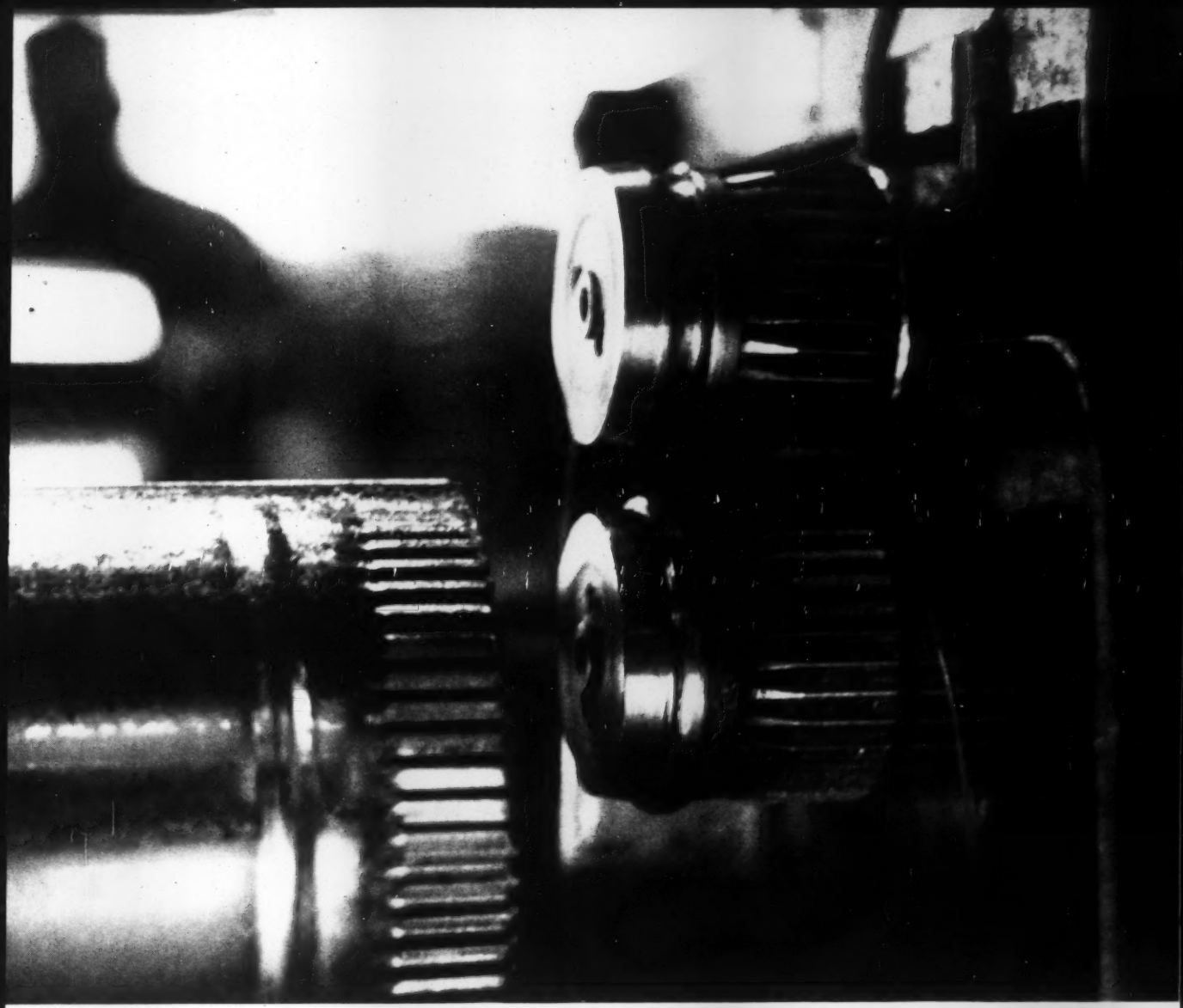
We are ☐ CONTRACTORS ☐ JOBBERS ☐ DISTRIBUTORS

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____



"NO REJECTS IN OUR SHOP! WE CRIMP CHIP-PROOF WEIRKOTE"

See for yourself, as so many others have. Put zinc-coated Weirkote through its paces. Give it the business—the toughest, most tortuous jobs in the shop. Crimp it, bead it, twist it, spin it, draw it. Work it to the limits of the steel itself. Then take a close look.

Not a chip or flake mars its smooth zinc surface! And why should they? Weirkote's continuous process integrates zinc and steel so tightly that chipping and flaking do not occur and a new high in corrosion protection is assured.

Can you imagine what this means to repeated, top-notch production results? To the goodwill of your customers who will continually get the best finished products on the market? To your peace of mind, rid, at last, of annoying, costly rejects?

In spite of all these advantages, Weirkote's cost is low. One more good reason why you should write today for a free 12-page booklet that explains in detail how Weirkote can help you. Weirton Steel Company, Dept. M-8, Weirton, West Virginia.

WEIRTON STEEL COMPANY

WEIRTON STEEL COMPANY

WEIRTON, WEST VIRGINIA

a division of

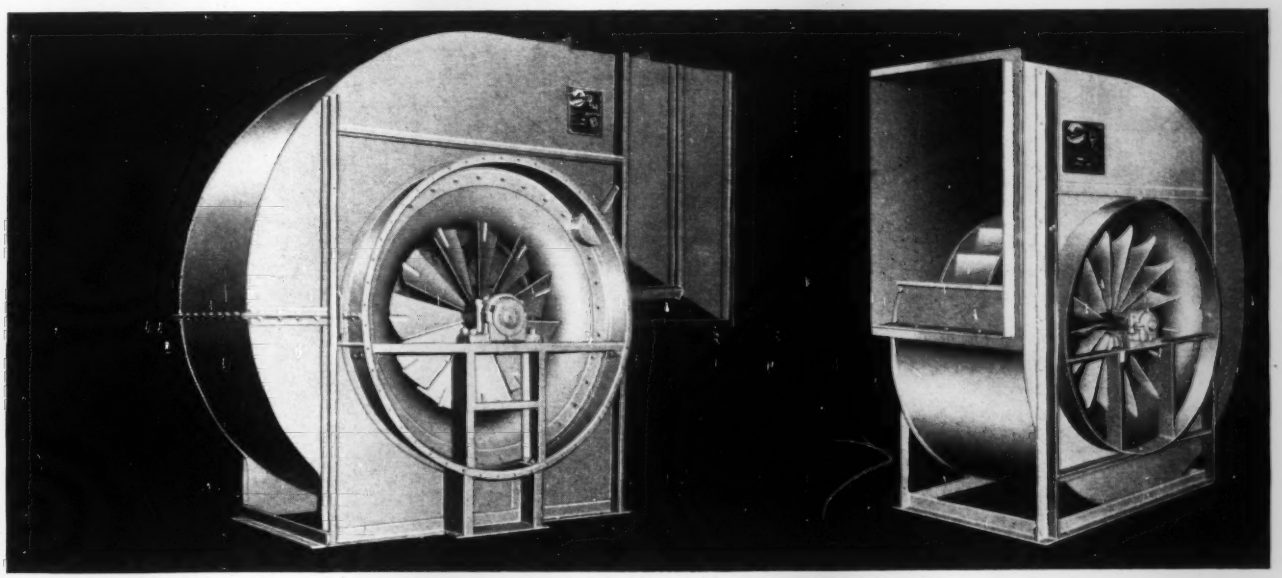
NATIONAL STEEL CORPORATION

So quiet you could hear his temperature drop!

Stretching a point? To be sure, but only because falling temperatures don't make much noise. Fact of the matter is, with "Buffalo" fans serving our imaginary hospital, you could **hear just** about anything, or nothing, the fan noise level is so low. This is only one of the reasons you should insist on "Buffalo" fans for your ventilating-air conditioning systems. If you would like to know more, read the opposite page.

THE "BUFFALO" TYPE "BHL" FAN FOR HIGH PRESSURE

THE "BUFFALO" TYPE "BL" FAN FOR MODERATE PRESSURE



For your high pressure systems (Class III and IV) "Buffalo" offers their Type "BLH" Fan. This fan also has an exceptionally low noise level while offering high mechanical efficiencies over a broad operating range.

In addition to the aforementioned "BL" design features, the type "BLH" has a divergent outlet to minimize cut-off turbulence. This divergent outlet not only insures smooth air flow and high static regain, it provides even pressure distribution at the outlet.

Famous "Buffalo" "Q" Factor quality construction is used throughout providing a long life of low-maintenance, trouble-free service. For your conduit air conditioning and other high pressure jobs, the specially designed "Buffalo" Type "BLH" has more to offer than any other suitable fan.

Here's a highly refined fan design suitable for your general air moving jobs. Low noise level is but one of the advantages of this design. Another is high efficiency, particularly important as horsepower requirements rise. A third consideration might be the minimum amount of maintenance necessary with the "Buffalo" type "BL" fan.

These and other desirable benefits are the result of a fan design offering an inlet bell and wheel shroud forming a true half-circle for smooth air entry. Cantilevered inlet vanes permitting low turbulence air conditions. And backward curved wheel blades with non-overloading characteristics.

This tells but a fraction of the story. If you want to be really sure of the fans on your next moderate pressure job, see that they are "Buffalo" Type "BL's".

Additional information on these and other "Buffalo" Fans can be obtained from your nearest "Buffalo" Engineering Representative. Or write us direct if you wish. Your letter will receive our prompt attention.

BUFFALO FORGE COMPANY
Buffalo, N. Y.
Buffalo Pumps Division, Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

because of dorex®...

THEY BREATHE BETTER AIR *at* WAYNE STATE UNIVERSITY

Minoru Yamasaki & Associates, Architect

Seen as a sign of the school's attitude toward advancing the cause for higher learning, Wayne's new AIA award-winning McGregor Community Conference Center has imposing significance. And just as significant is the careful attention given to the comfort needs of the Center's many occupants.

An installation of 44 high efficiency Dorex activated carbon air purification cells purges recirculated air of irritants and purifies it for sanitary re-use in the Center's large air conditioning system.

The reputation of Dorex for exceptional efficiency and adaptability is backed by more than 25 years of practical experience in the design and manufacture of air purification equipment. And a systematic replacement service—offered exclusively by Connor—guarantees the continuous, effective operation of every Dorex installation.

As shown here, the Dorex installation at Wayne is assembled in one central location. Activated carbon cells are arranged 11 wide by 4 high, and are protected by high efficiency dust filters. By this arrangement, which demonstrates the installation flexibility of Dorex units, space-conservation and exceptional purification efficiency are achieved.

CONNOR... for Constant Comfort Conditions

For complete information on Dorex equipment, request new Bulletin 108A.

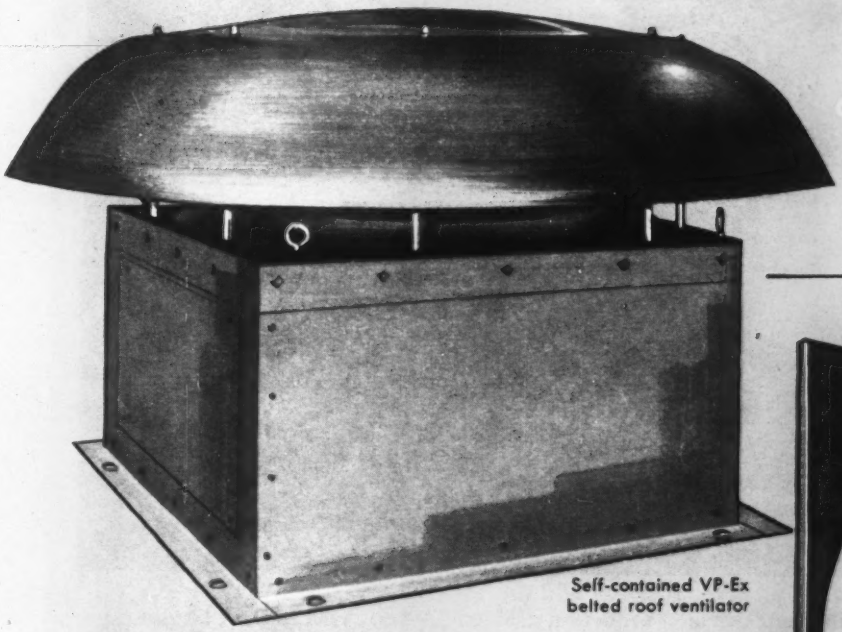
CONNOR ENGINEERING CORPORATION

DANBURY • CONNECTICUT

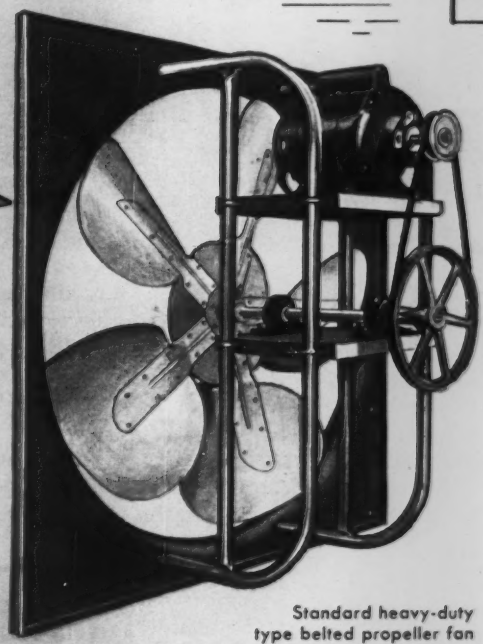
CONNOR ENGINEERING CORPORATION

dorex® air recovery

VP-EX PROPELLER-TYPE belted roof ventilator



Self-contained VP-Ex belted roof ventilator



Standard heavy-duty type belted propeller fan

The outstanding performance of the VP-Ex Belted Roof Ventilator is derived from insistence on quality at every step—from its galvanized construction through its complete industrial-type propeller fan. This large-capacity workhorse keeps overall height at a minimum while providing efficient operation and proper clearance between air discharge and roof. Capacities from 4450 CFM to 33900 CFM; also available in smaller direct drive sizes.

Send for Bulletin 582.

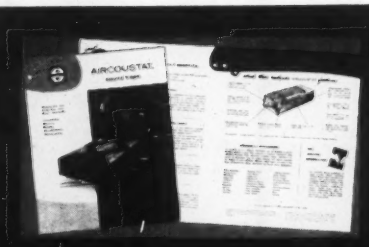
nyb

THE NEW YORK BLOWER COMPANY

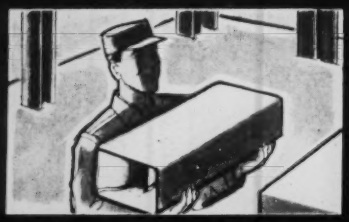
SALES OFFICES: 3149 SOUTH SHIELDS AVENUE • CHICAGO 16

7 ways AIRCOUSTAT®
can save you time and money

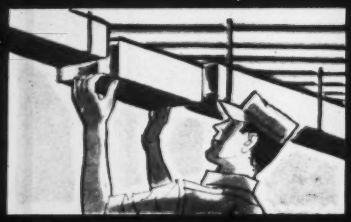
Sound Traps . . . with Guaranteed Results



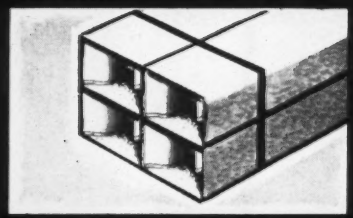
1) Easy to select—Just 3 steps to specify proper model. Save time, avoid errors.



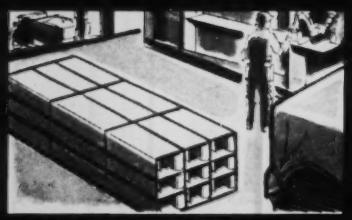
2) Easy to handle—No riggers or special equipment needed. Large units composed at job site.



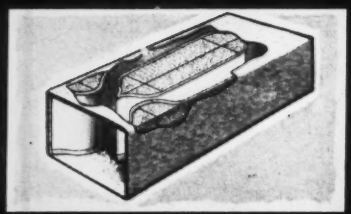
3) Easy to install—Units are installed the same as ductwork. Units have 2" extensions.



4) Fits all duct sizes—Big units are easily assembled from small Aircoustat units.



5) No storage problem—Units are delivered right to the job site, ready to install.



6) No maintenance—Units are fire-resistant, dust-proof and built to last a lifetime.

7) Guaranteed results—Solves every noise reduction problem. Units are completely reliable.

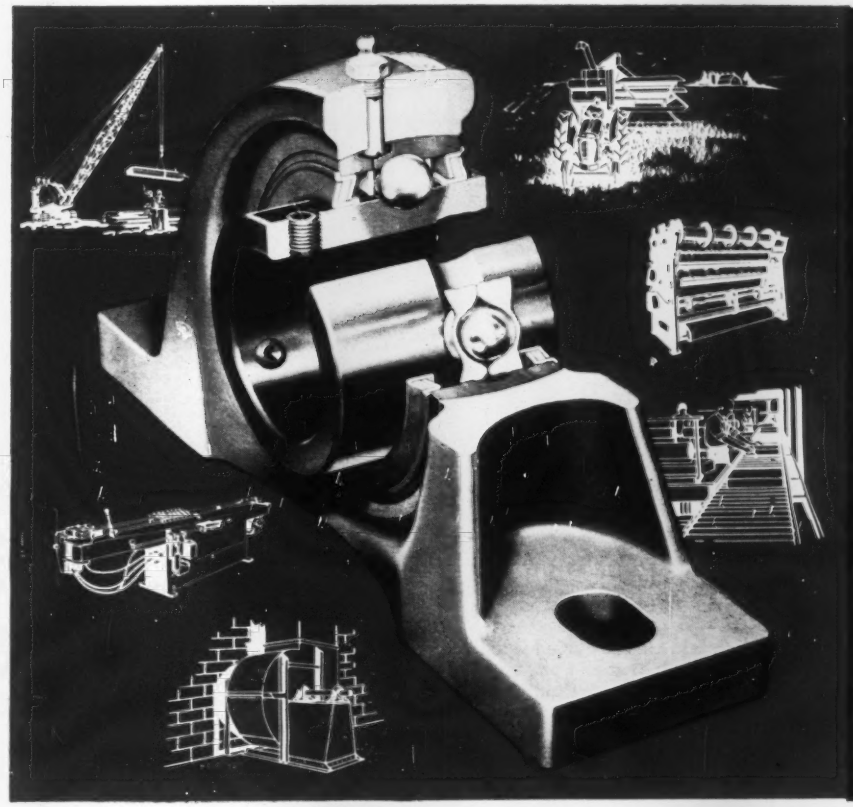
Pre-engineered by Koppers to eliminate guesswork, unnecessary calculations and difficult installations, AIRCOUSTAT Sound Traps guarantee trouble-free silencing of all duct-transmitted noise . . . at a savings in time and money to you.

AIRCOUSTAT selection is quick, simple and reliable. A choice of over 60 stock models, fabricated in 6 lengths, solves every noise reduction problem. AIRCOUSTAT is built to give a lifetime of maintenance-free service.

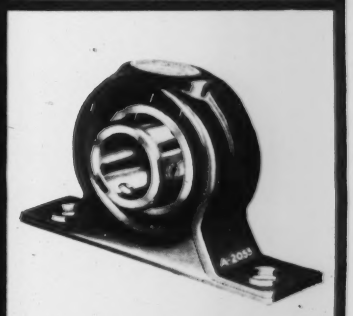
Write today for your copy of the AIRCOUSTAT Selection Manual, a quick guide to the right unit or combination of AIRCOUSTAT units to eliminate duct-transmitted noise in all air handling systems. Write KOPPERS COMPANY, INC., Sound Control Department, 3409 Scott Street, Baltimore 3, Maryland.

KOPPERS®

SOUND CONTROL
METAL PRODUCTS DIVISION
Engineered Products Sold with ***Service***



"LP" PILLOW BLOCK



RUBBER MOUNTED PILLOW BLOCK

SEALMASTER®

...quality that builds acceptance!

There is no greater assurance of performance than quality. SEALMASTER gives you that quality in a complete line of ball bearing units, providing a wide range of mountings in shaft sizes from ½" to 4 15/16".

Patented SEALMASTER "Zone Hardening" affords simplified, secure locking to shaft. One piece housings eliminate loose pieces that increase your assembly costs. And when cost is a primary requisite there's no need to sacrifice quality.

The new SEALMASTER "L" Series provides a precision, low-cost line of self-aligning ball bearing units. They are permanently sealed and pre-lubricated with a high grade lubricant for long life.

SEALMASTER rubber mounted units provide extremely quiet operation where noise is an important factor.

Whatever you look for in a bearing unit — quality — performance — economy — there's nothing comparable with SEALMASTER!

WRITE FOR CATALOG 454.

SEALMASTER® BALL BEARING UNITS

SEALMASTER BEARINGS

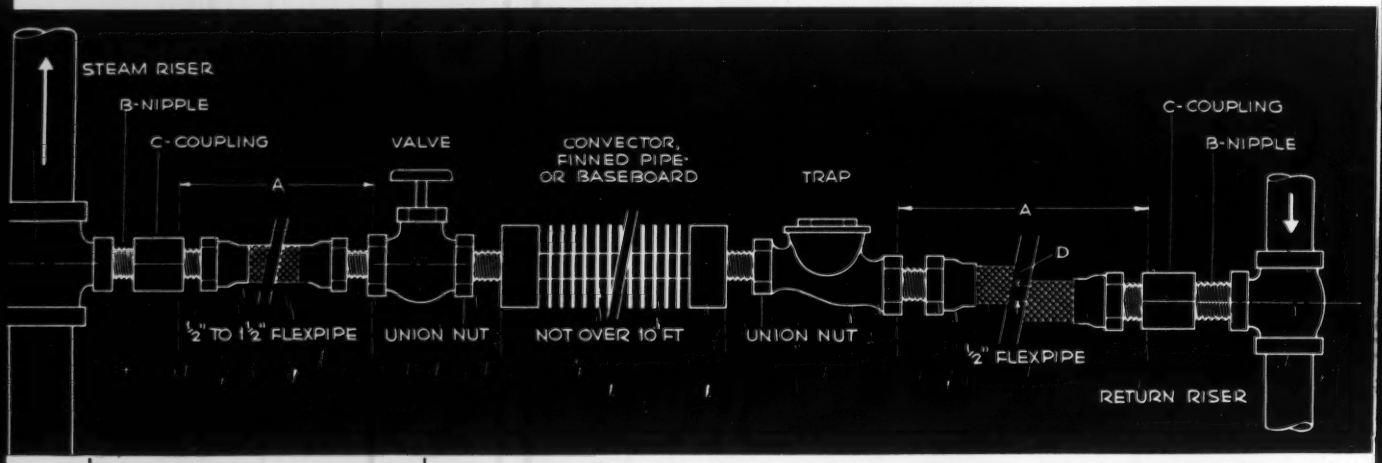
A DIVISION OF

STEPHENS-ADAMSON MFG. CO.

47 RIDGEWAY AVE., AURORA, ILL.

APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe



DIMENSIONS

I. D.	A	D (max.)
½"	10"	½"
½"	20"	1¼"
¾"	11"	½"
¾"	22"	1¼"
1"	12"	½"
1"	24"	1¼"
1¼"	13"	½"
1¼"	26"	1¼"
1½"	14"	½"
1½"	28"	1¼"

NOTES:

Flexpipes will take care of vertical movement and permit easy alignment of piping without straining trap, valve bodies or heating elements and causing leaks.

Offset "D" is shown for location above riser anchor only. Install with this offset to avoid trapping condensate. Offset shown is maximum—not to be exceeded when installed cold. Select length "A" according to riser expansion expected.

Nipple "B" and coupling "C" may not be needed in some cases. When center lines of risers and heating elements are not in the same plane, turn the riser tees 45 or 90 degrees and use elbows and nipples as required.

Select valve and trap body pattern as required for the job.

Sweat fittings furnished when needed.

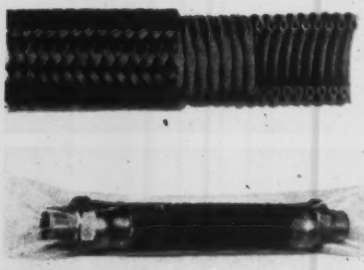
Streamlining a steam heating system with flexible connectors

To conserve space, simplify installation, and provide greater reliability, the use of Flexpipe flexible connectors to streamline heating systems is becoming more important.

In the simplified steam system using convectors, finned pipe, or baseboard radiation, shown above, for example, Flexpipes will solve many problems. They eliminate three elbow swing connections to compensate for expansion and contraction in the risers. The piping can hug the wall—there's no need to go through the floor to make connections from the floor below. There are fewer connections, fewer possible leaks. There is no strain on trap and valve bodies or on the heating elements. Flexpipes help make possible a system that will operate dependably through the years with little maintenance.

IN HOT WATER SYSTEMS, Flexpipes can help do a similar streamlining job. The trap is replaced by a balancing elbow and an air valve.

WHERE TO BUY. Flexpipe connectors come in convenient standard sizes from ¼ inch through 2 inch, and are sold by leading distributors. They can show you samples and answer questions about service applications. For the name and address of the one serving your area, or for more detailed information, write to: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass, Ltd., New Toronto, Ont.

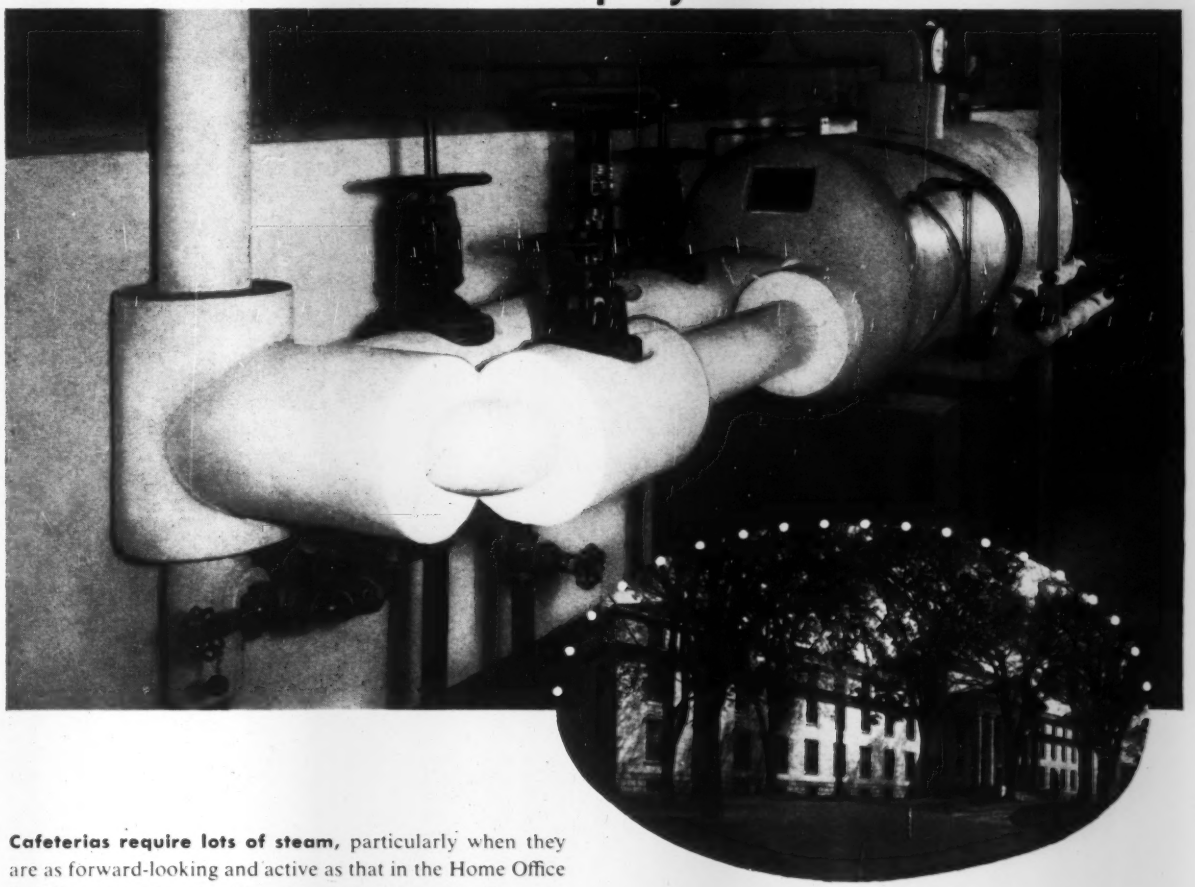


FLEXPIPE has core of seamless tin bronze tubing corrugated for flexibility. No packing. 100% tight. Tin bronze wire braid covering for extra strength. Brass fittings attached. Packaged in clear, tough polyethylene bag for easy identification, handling and warehousing.

Flexpipe® an **ANACONDA®** product

WHITLOCK STEAM GENERATOR

Selected for Insurance Company Cafeteria



Cafeterias require lots of steam, particularly when they are as forward-looking and active as that in the Home Office Building of the Hartford Fire Insurance Company Group in Hartford, Connecticut, serving about 1,100 lunches daily. Every operating detail of this modern, efficient, "last word" cafeteria was carefully selected to assure long life and reliable, economical performance. The Whitlock Steam Generator selected for this installation has fully met expectations in every way and its record of low operating cost is most satisfactory.

You'll find water heating equipment by Whitlock in many important buildings from coast to coast—office buildings, hospitals, laundries, hotels, schools, and industrial plants . . . large and small. Whitlock Steam Generators, Storage Heaters, Instantaneous Heaters, and Convertors have an outstanding reputation for performance, and their proven design means minimum operating and maintenance costs. Long experience enables us to offer standardized water heaters for the majority of applications . . . we also design and build water heaters for special needs.

We will gladly assist you with any water heating problems . . . : ask us for suggestions and illustrated bulletins.

Whitlock HEATERS

THE WHITLOCK MANUFACTURING CO.

44 South Street, West Hartford 10, Conn.

NEW YORK • BOSTON • CHICAGO • PHILADELPHIA • DETROIT • RICHMOND

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Specify ELLICOTT Storage and Pressure Vessels

WITH CUSTOMIZED CORROSION CONTROL

Stop Corrosion or contaminated contents before it starts by specifying Customized Corrosion Controlled Storage and Pressure Vessels by Ellicott.

Ellicott has successfully solved many problems involving the use of steel, steel alloys and non-ferrous metals in the fabrication of vessels and entire systems. Some of the more important special metals and alloys used are: Copper Silicon, Clad Steels, Stainless Steels, Nickel, Monel, Inconel and Aluminum. A complete line of Novelon Linings of cement, rubber, lead, copper and the new plastic linings that allow much higher heat resistance can be applied to low cost carbon steel.

Ellicott vessels with Customized Corrosion Control can solve the corrosion problems in the storing and processing of water, acid, food, chemicals, air and gaseous vapors. Send us your corrosion problem today. Representatives in major cities for Hot Water Generators • Heat Exchangers • Storage Tanks Special Linings and Metal Fabrication.

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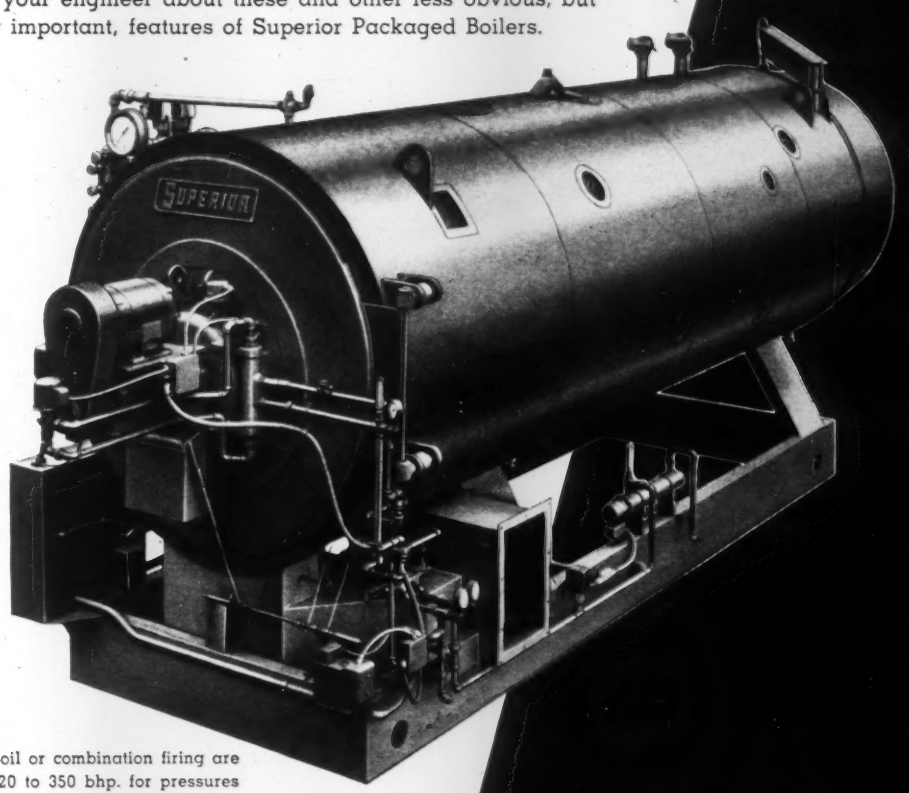

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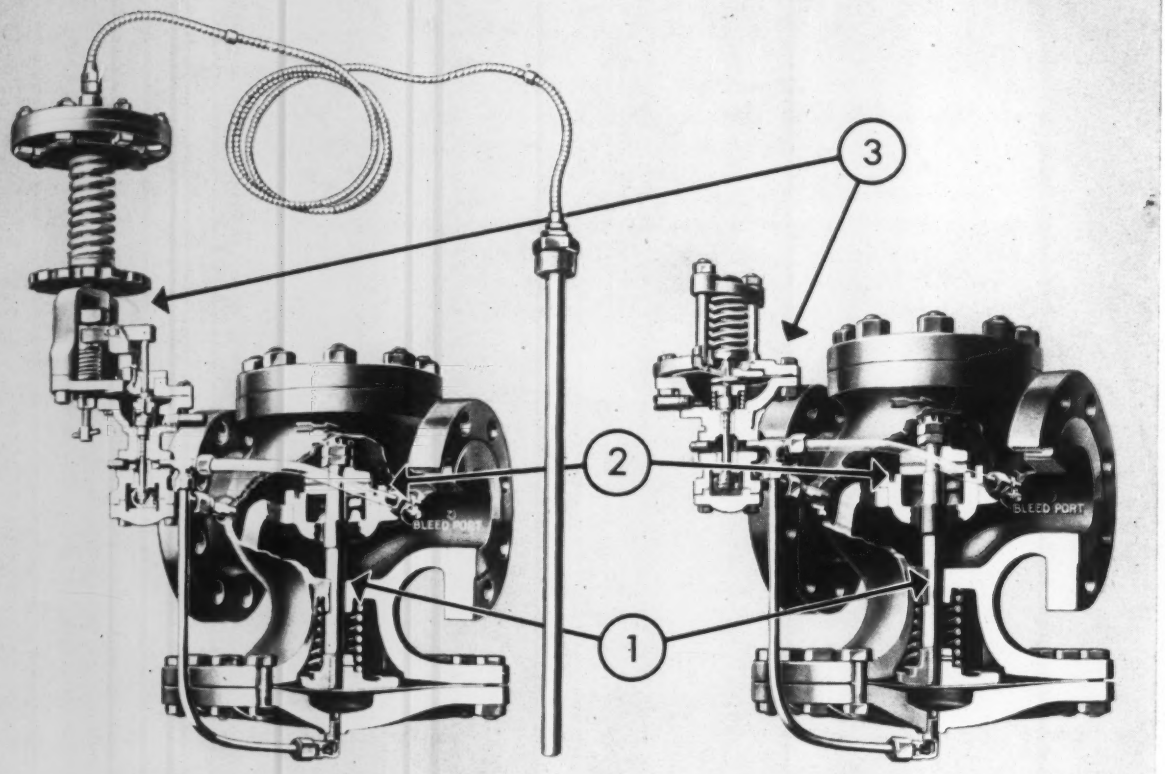
3 Tips for Low Maintenance in Automatic Regulating Valves



Spence ET124 Temperature Regulator

Spence ED Pressure Regulator

No engineer has to be told that downtime of regulating valves is costly—and a nuisance.

Nowadays the men who keep these valves operating want to make sure they aren't stuck with a maintenance headache for the life of their valves. That's why we are outlining this simple check list which covers three important features which keep maintenance costs down.

1. Stuffing boxes are probably the number one time consumer in valve maintenance. No matter how you figure it, repacking stuffing boxes is costly.

That's one reason Spence uses a "balanced" diaphragm construction which eliminates stuffing boxes. Simple stem guiding and large metal diaphragm operation reduce sticking and binding to a minimum.

2. Another problem is replacement of seats and discs when they've been cut by steam. Today you can forget about this problem entirely by insisting on an unconditional guarantee against wire-drawing. Spence, for instance, uses SECO Metal seats and discs and gives such a guarantee.

3. Any valve designed to control temperature and pressure within tight limits can be affected by dirt in the steam lines. You can't get a guarantee against this, but you can specify a valve that makes trouble shooting easy. Here's the tip:

Make sure your regulating valve is controlled by an external pilot. If trouble develops, it is easy to find out if it is in the pilot or the main valve with a simple test.

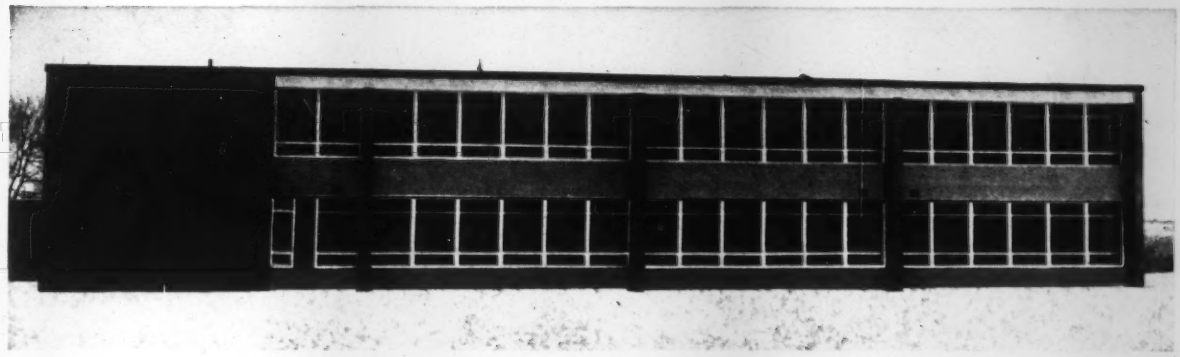
If the trouble is in the pilot, you can remove it without taking the main valve out of the line.

The quickest way to get the regulator working again is to install a spare pilot. This is easy—and in the Spence design it is not expensive to carry spare pilots. Spence pilots fit all sizes of Spence main valves.

These maintenance advantages plus other advanced features are available in a wide range of Spence automatic regulating valves. For more information write for the Bulletin TE.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

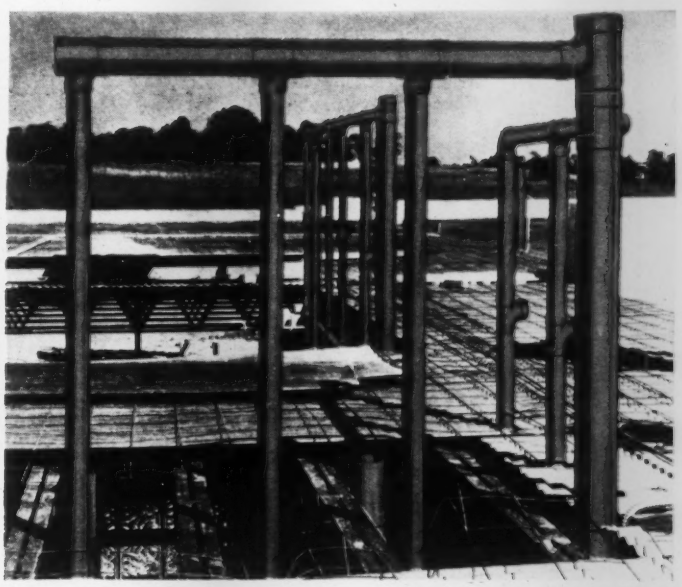
SE-144



GOWER SCHOOL ADDITION, Hinsdale, Illinois. *Architect:* Wight & Schlaebitz, Downers Grove, Illinois. *Plumbing and heating contractor:* Jerry & Phil's Plumbing & Heating, Inc., Brookfield, Illinois.

SUPERIOR ALL-COPPER PLUMBING IN THIS SCHOOL AT LOWER COST TO TAXPAYERS

COPPER SANITARY DRAINAGE LINES roughed-in among structural members at Gower School. This space-saving installation would have been impracticable with heavy, bulky pipe requiring threaded or caulked joints.



COPPER SANITARY DRAINAGE LINES for second floor lavatories at the Gower School. Light weight of copper tube and ease of making solder joints save many dollars on multiple installations like this. Compact assemblies eliminate wide plumbing walls, give greater usable floor area.

Phil Bergeron and Jerry Wehrmeister, plumbing contractors near Chicago, have found that the installation economies with copper tube and solder-joint fittings enable them to offer all-copper plumbing—water supply *and* sanitary drainage—at a cost lower than competitive bids based on installing ferrous piping. Recent jobs awarded to them as low bidder include the Gower School, the LaGrange Township Junior High School, a church, health center, two restaurants and a store. Anaconda was used for all these jobs. Phil Bergeron says, "We specify Anaconda Copper Tube and Fittings because their consistent fine quality and close tolerances makes our work easier and keeps the job costs within our estimates."

Contractors, builders, and architects the country over are finding that they can provide long-lasting, low-maintenance all-copper plumbing at a cost competitive with ferrous piping. For information on Anaconda Copper Tube and Fittings, write for a copy of Publication C-33. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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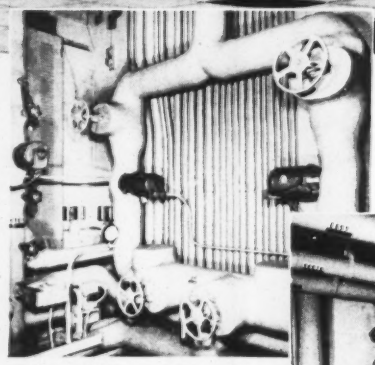
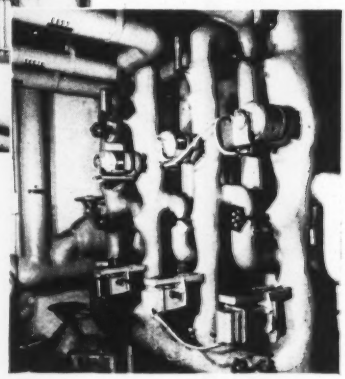
"ENGINEERED FOR THINKING" ...WITH 22 QUIET B&G BOOSTER PUMPS





B&G Boosters installed in various heating circuits.

B&G BOOSTER PUMP

Hydro-Flo SYSTEM

BELL & GOSSETT
COMPANY

Dept. FW-5, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

International Minerals and Chemical's new administration and research center, Skokie, Illinois, has been described as "engineered for thinking." In keeping with that objective, twenty-two *quiet* B&G Boosters were selected as the pumps for the heating circuits of the four buildings and the snow melting panels.

B&G Boosters and larger Universal Pumps are designed and built specifically for circulated water heating and cooling systems, in which they satisfy the all-important requirement of *silent, vibrationless* operation. Over 3,000,000 are today installed in such systems.

Among the features of B&G circulating pumps are specially built, more costly motors, tested for quiet running...oversized shafts of hardened alloy steel... long sleeve bearings...noise dampening spring couplers...oil lubrication and leak-proof mechanical seals. They can be serviced without removing from the line.

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Expansion Compensators
Braided Bronze Flexible Connectors

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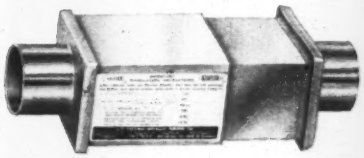
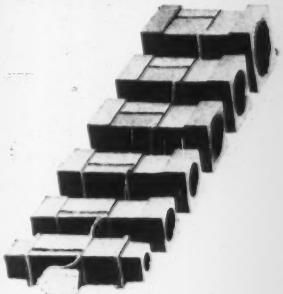
Temp. 800 F

Pat. Pend.

TYPE 7Q-T WITH COPPER TUBE ENDS
Maximum Pres. 200 PSI Maximum
Temp. 300 F



Pat. Pend.



/ Q QUADRA-SIDE EXPANSION COMPENSATORS

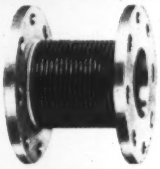
"BMH" Flexible Connector

"USF" Vibration Absorber

KEFLEX 7Q FINTUBE Assembly

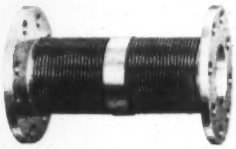
DUAL KEFLEX 7Q With Anchor Base

KEFLEX EXPANSION AND VIBRATION ASSEMBLIES



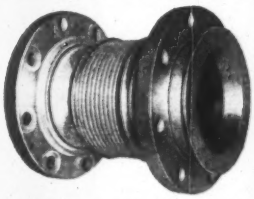
SLOTTED BOLT HOLES

158-12E EXPANSION JOINT



158-15-12E DUAL EXPANSION JOINT

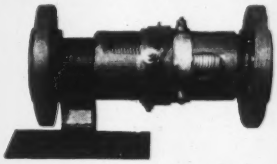
158-15-9E DUAL EXPANSION JOINT



308-14E EXPANSION JOINT

151-2V VIBRATION ABSORBER

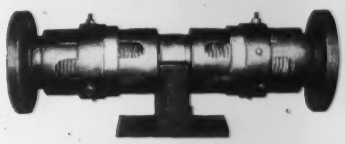
301-4-14S VIBRATION ABSORBER



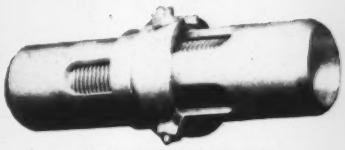
KTO-300-EAB-14E

KEFLEX With KETROL GUIDES

Pat. Pend.

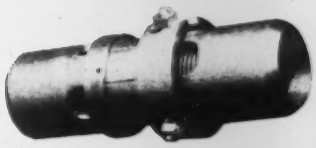


KTO-300-15-CAB-14E

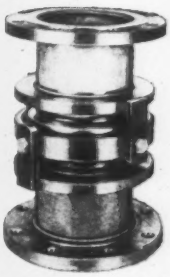


KTO-300-2E EXTENDED

OUTSIDE GUIDES CAGE CONTROLLED

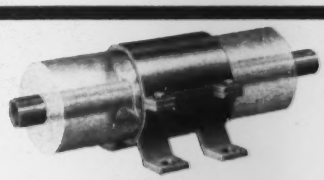


KTO-300-2E COMPRESSED

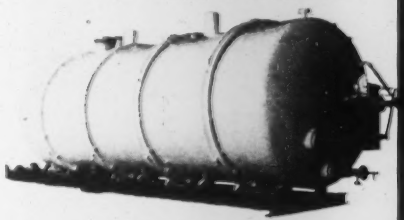


KEFLEX GIMBAL UNIT

TYPE P
KEFLEX PULSCO SHOCK TRAP



TYPE M
KEFLEX MAVE PIPE GUIDE



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The No. 701 globe and No. 702 angle valves are for 150 pounds working steam pressure and 300 pounds water, oil, air or gas pressure. They are available in sizes from ⅛" through 3".

You can buy these composition disc valves from your O-B distributor. Ask him about the complete line of bronze O-B globe, angle, check and gate valves.

OHIO BRASS COMPANY • MANSFIELD, OHIO

"open for discussion"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Asks for Further Design Information On Everett School HTHW Heating Job

THE ANALYSIS and subsequent use of high temperature hot water heating for the Everett School, as described by Anton Krapek in his article, *How HTHW Meets Heating Needs of This New School* (August), restates and emphasizes many of the factors relating to heat distribution now somewhat well established and substantiated by our work.

Were the various types of high temperature hot water systems analyzed before selecting nitrogen gas pressurization? Where is the expansion tank connected into the system? How is the nitrogen fed into it? How is the nitrogen pressure controlled?

Was the tank sized for the full water expansion of the system from startup temperature to operating temperature? What size tank was installed and what is the water volume content of the system? The use of a vertical tank is good, we feel, as a means of conserving floor space.

We note that in none of the heated areas was HTHW used directly. Was consideration given to this possibility since it permits further simplification of the installed system in some of the areas where future cooling is unlikely?

The use of extra heavy black steel pipe for the HTHW piping interests us since the requirements of the ASA B31.1 Code for Pressure Piping permits the use of Schedule 40 pipe to higher operating conditions than this system encounters. We feel that the safety requirements set forth in B31.1 are entirely adequate for these systems.

JOHN S. BLOSSOM
Ziel-Blossom & Associates
Consulting Engineers

THE AUTHOR'S REPLY — Nitrogen was selected to charge the system since we feel it does a much better job than compressed air. It will not yield to water as air would by giving up oxygen, nor does it contribute to oxidation of piping, boiler tubes, etc.

The tank is connected into the system on the return piping ahead of the boiler pumps. Nitrogen is fed into the tank through pressure regulating valves directly from nitrogen bottles.

The tank is 42 in. in diameter, 10 ft high, and has a capacity of 96 cu ft, sized for the volume of expansion required for the piping system, boilers, and converters. The entire system will be "boiled out" to permit the water to liberate as much air as possible before the introduction of nitrogen.

We realize that HTHW radiation and equipment could have been used and are familiar with its merits. However, normal temperature equipment was used at the request of the local school board.

It is true, too, that Schedule 40 pipe could have been used in this project. But design practice in this area is to use extra heavy piping on projects for 100 psi "high pressure" systems.

ANTON KRAPEK
Vice President
E. Roger Hewitt Associates, Inc.
Professional Engineers

Thinks Freeze Protection Design Article Should Be Required Reading

JOHN H. CLARKE'S *How to Design Freeze Protection for Makeup Suppy Air Systems* (June) is an interesting review of the problem and should be required reading for everyone involved in the design, manufacturing, selling, or use of such equipment.

It is doubtful that there is any individual piece of equipment that goes into the modern industrial plant where there is less coordination between the people involved than there is in the installation of makeup supply air systems. Although almost every new plant

has one or more of these "air supply" systems installed, a careful survey of the field has shown that some of the so-called package units have merely been converted from units originally designed for 100 percent recirculation. Their operation is further complicated by the control engineer, as he often ignores the fact that the units must supply air at a preselected temperature throughout the working day and not be operated spasmodically.

To be more specific, it is the exception rather than the rule when outside air is supplied to such units in a manner that will provide equal velocity over all parts of the coil. Measurements on installations have disclosed that over some sections of the coil the velocity was several times that calculated. In some cases, reverse air flow through certain parts of the coil has been observed. Such conditions result in the problems as outlined by Mr. Clarke. The bypass sections are often too small to handle the quantity of air without excessive velocity. Because of this, blowers do not always deliver their rated volumes and the air temperatures fluctuate more than normal.

These undesirable conditions are further complicated by the improper sizing of steam valves and sequencing of controls. The popular method of opening a steam valve to the wide open position by an outdoor thermostat whenever the temperature is near freezing, invariably results in overheating at mild weather with the result that the employees shut off the unit. The practice of modulating the face and bypass dampers and the steam valve simultaneously results in undesirable hunting of the controls, unsatisfactory temperatures, and sometimes coil freezing.

As Mr. Clarke has pointed out in previous articles, the lack of or improper venting of the coils and unsatisfactory trapping invariably leads to unsatisfactory operation of the unit and to coil freezing.

As nearly everyone admits that they have difficulty with units handling 100 percent outside air, it would seem that definite steps should be taken to eliminate the conditions that cause the problems. Some of the things to be considered are:

1) Air has weight and the inlet and outlet of the system should be designed to handle this air with a minimum amount of turbulence and friction.

2) The coil should have the maximum fin spacing that is compatible with practical sizing of the coils, thereby eliminating much of the problem of cleaning the fins.

3) Coils should be, as Mr. Clarke states, installed vertically with proper drainage, trapping, and venting.

4) The valve should be sized to provide sufficient resistance to allow control of the steam, and dampers properly selected and operated to control the air flow as desired.

5) The blower or blowers should be selected and located in the casing in such a way that they can handle the air specified against the resistance and turbulence of the unit.

K. E. Robinson
Ventilation Engineer
Industrial Hygiene Dept.
General Motors, Corp.

Concurs with Author on Refrigerant Piping Design Considerations

I HAVE READ the interesting and informative article, *How to Design Refrigerant Piping*, by W. C. Smith (July and August), and offer the following comments:

The author discusses a frequently overlooked fact in connection with the layout and installation of this type of piping, namely that of contraction and expansion resulting from changing temperatures in piping systems. I can recall at least two cases of costly pipe failures that were attributed to the destructive forces set up in these piping systems by both high and low temperature fluids. In these cases, the consulting engineer designing the systems did not consider these forces. As a result, failures took place.

One failure was an ammonia compressor discharge pipe that connected the compressor to the condenser. The other failure was a 2 in. steam line with a pressure of about 200 psig. Both failures were quite costly.

The author's discussion on the use of threading compounds, along with his comments on pipe joints, is well worth remembering. Much of the trouble caused by leaking ammonia joints is often the direct result of failure of the pipe erector to properly lubricate the threads and dies of portable thread cutting equipment. Unless a good grade of thread cutting oil is used, defective threads may result. In the place of good, sharp, clear-cut, standard taper threads, such as are required to insure tight joints, the threads will be rough, burred, and broken and may leak when the system is placed in service. Oftentimes too, the dies themselves are damaged due to overheating when oil isn't used.

If the threads of both the fitting and pipe are cleaned of oil and dirt and a paste made of litharge and linseed oil is used when making up screwed pipe joints, a satisfactory job will result. The paste should, however, be placed on the pipe threads only, particularly in the case of the smaller fittings. If the paste is applied on the threads of the fitting, a hardened ring of paste will form at the end of the pipe and produce a reduction of net area of the fitting.

Exposed threads, as pointed out by the author, are very susceptible to atmospheric corrosion. In ammonia work, the recess of all fittings may be filled with litharge paste after the joint is made up. This will protect what otherwise would be exposed threads.

The author's comments on the installation and care of low temperature pipe covering are quite correct. I have just completed an investigation of two fairly large ammonia refrigerating plants in which all of the

low temperature pipelines were insulated. The material was good, but the loose manner in which the insulation had been installed proved its downfall. The installation was made by the plant owner's crew, who proceeded to disregard all installation instructions furnished by the insulation manufacturer. After only two years of operation with this system, the entire installation was practically worthless. All this could be attributed to ignorance, laziness, and indifference on the part of those doing the installation work.

Mr. Smith is to be commended for his excellent treatment of this subject.

C. T. Baker
Consulting Engineer

Takes Issue with Latent Heat Loss Data Calculated for Poultry, Swine

F. F. Stevenson's article, *Evaluate Sensible, Latent Heat Gains for Close Temperature, Humidity Control* (June) is very interesting since my company has had considerable experience in ventilating and cooling both poultry houses and farrowing houses for swine. Mr. Stevenson is to be commended on his careful attention to details in designing a system suitable for both winter and summer.

He states that the latent heat emission from chickens varies widely with the temperature. This remark is contrary to our observations of the heat physiology for both chickens and swine. The chicken is a nonsweating animal and can only raise its loss of heat by evaporation slightly through increased respiration at elevated temperatures.

Listed below is a comparison of heat loss by chickens based on data published in *Heat and Moisture Production of Laying Hens*, by Hajime Ota, H. L. Garver, and Wallace Asby:

	50 F latent	100 F latent
Stevenson	6.0	37.4
Ota, et al	8.0	12.0

The 100 F data was extrapolated from 90 F figures reported by Mr. Ota and might be slightly in error. But it cannot be reconciled with Mr. Stevenson's data. Furthermore, it is difficult to understand why the article emphasizes the variations in latent loss of heat by chickens and swine when they are nonsweating animals and have an almost constant loss of latent heat.

Mr. Stevenson uses his example for summer conditions at 100 F. At this temperature the mortality loss of chickens and swine would be high. An evaporative cooling system would be a judicious investment as it would reduce the temperature to within a few degrees of the wet bulb. Most evaporative cooling systems for farm animal shelters use a 1 min. air change which will give a house temperature of 85 F or less. This not only prevents mortality, but increases egg production and improves the feed conversion ratio.

Robert S. Ash
Assistant to the President
International Metal Products Co.

"open for discussion"

continued

The author's reply — All living tissue in a land and air environment generates moisture and it must be eliminated. There are various ways of doing this. Chickens have no sweat glands, but instead have a number of air sacs or bladders inside their bodies. Air passes from the lungs to these sacs, where it absorbs the moisture produced by the tissues. The air, with its vapor content, is then exhaled. The production of moisture by the tissues of a chicken varies directly with the temperature; the hotter it is, the more moisture produced and the faster the chicken must breathe in order to get rid of it.

I do not pose as an authority on the metabolism of chickens. My figures and values came from data readily available. This data indicates a tremendous upsurge in the percentage of latent heat to total heat as the environmental temperature exceeds 50 F.

As to chicken house temperatures, I would say that dry bulb readings of 100 F are common in the Midwest. With an outside temperature of 95 F and a hot sun beating down on the roof, it is difficult to hold even 100 F by ventilation alone.

Evaporative cooling is wonderful in Arizona, with its low wet bulb temperatures. But here in the Midwest the climate is such as to make it impractical, except in isolated cases.

F. F. Stevenson
Consulting Engineer

Averaging Controls Are No Solution To Problem of Poor Distribution

John H. Clarke has produced a valuable series of articles on industrial ventilation and I understand there are more to come. I suggest, when this series is finished, that Heating, Piping & Air Conditioning make the entire group available as a reprint.

In Mr. Clarke's article, *How to Design Freeze Protection for Makeup Supply Air Systems* (May), mention is made in several places of "averaging" controls. At best, averaging is merely an admission of other defects in the system. These defects should be corrected because averaging won't solve the problems.

Two thermostats at opposite ends of a room can be made to produce a combined signal representing the average of the two temperatures. If 70 F is the desired temperature, the two thermostats would be just as satisfied if one measured 60 F and the other 80 F as they would be if both were measuring 70 F. This is a distribution problem and a dozen thermostats will not correct it.

Likewise, a long averaging temperature bulb in a duct handling stratified air will permit reasonably good control, but will not correct any of the other problems associated with the stratification.

The trouble with averaging controls is that too many engineers consider that this solves all the problems as-

sociated with stratification or maldistribution. Actually, it solves only the control problem, leaving the others to go begging.

H. W. Alyea
Director of Engineering
Johnson Service Co.

The author's reply — Mr. Alyea's comments are greatly appreciated. It is true that averaging thermostats cannot correct defects in a system, and his cautioning remarks should be well heeded. Averaging room thermostats are not particularly desirable. But when set at approximately the same temperature in a single large space having an uneven heat load and insufficient justification for zoning, they will provide an averaging of the room temperatures, as intended. This does not mean that the space temperatures will necessarily be uniform. Where the variation in heat load in a space is consistent, this may be balanced out in part by air supply balance: that is, by providing more air to the warmer areas.

John H. Clarke
Engineering Design Supervisor
Air Conditioning and Power
Visking Co.
Div. of Union Carbide Corp.

Editors' note: With the tremendous interest generated by Mr. Clarke's articles on industrial ventilation, this series is being reprinted in booklet form. This special printing is now in work and copies will be available shortly at nominal cost.

Shouldn't More Controls Be Added To Hot Water Tempering Unit?

The article, *How to Design Hot Water Heating to Protect Against Freeze-ups*, by S. I. Rottmayer (July), should be of interest to many engineers. Perhaps its greatest value is in bringing to the attention of plant personnel that hot water systems can be used to temper outside air.

Perhaps I have a tendency to be overly cautious, but I believe that some additional controls would be justified on a hot water tempering unit. I am sure that Mr. Rottmayer would agree that the out-side dampers should be controlled so they would be in a closed position whenever the fan motor was shut off, in order to prevent cold air from entering the coils.

It would seem advisable to use an aquastat on the discharge of the coil that would shut down the unit if the water temperature is reduced below a predetermined setting, as it is believed it would be a safer operation than to use only a freezestat in the air downstream from the coil. If the unit is designed as a 100 percent outside air supply system, it would seem advisable to have the controls so arranged that, when the unit is started, the recirculating pump and the outside air dampers would both be energized. When the relay in the damper system makes contact and the aquastat at the discharge of the coil is satisfied, then the blower would be started. Otherwise it would seem there would be a possibility of subzero air going across the coil before sufficient warm water was supplied to guarantee satisfactory operation.

— K. E. Robinson
Ventilation Engineer
Industrial Hygiene Dept.
General Motors Corp.

The author's reply — Mr. Robinson's comments on additional controls are well taken. Controls for outside air intake dampers, to close them automatically whenever the fan is not running, are essential and, I believe, universally used. I was red-facedly surprised to learn that I neglected to describe them in the article.

The use of an aquastat in the leaving water in place of, or in addition to, the suggested freezestat in the air downstream from the coil and the use of still additional controls are preferences and refinements to which I take no exception. However, a general word of caution may be suggested about excessive use of safety controls: They should be employed with consideration given to investment cost weighed against expected returns. The cost of safety controls actually is a premium for insurance against equipment failure or damage and should be so evaluated. It is well, therefore, to make judicious use of safety controls, with the knowledge that:

1) Such controls, in themselves, are not infallible.

2) A false sense of security may follow the use of multiple safety controls, resulting in abandoning the vigilant supervision that is due any mechanical equipment by the operating personnel.

S. I. Rottmayer
Consulting Mechanical Engineer
Samuel R. Lewis and Associates

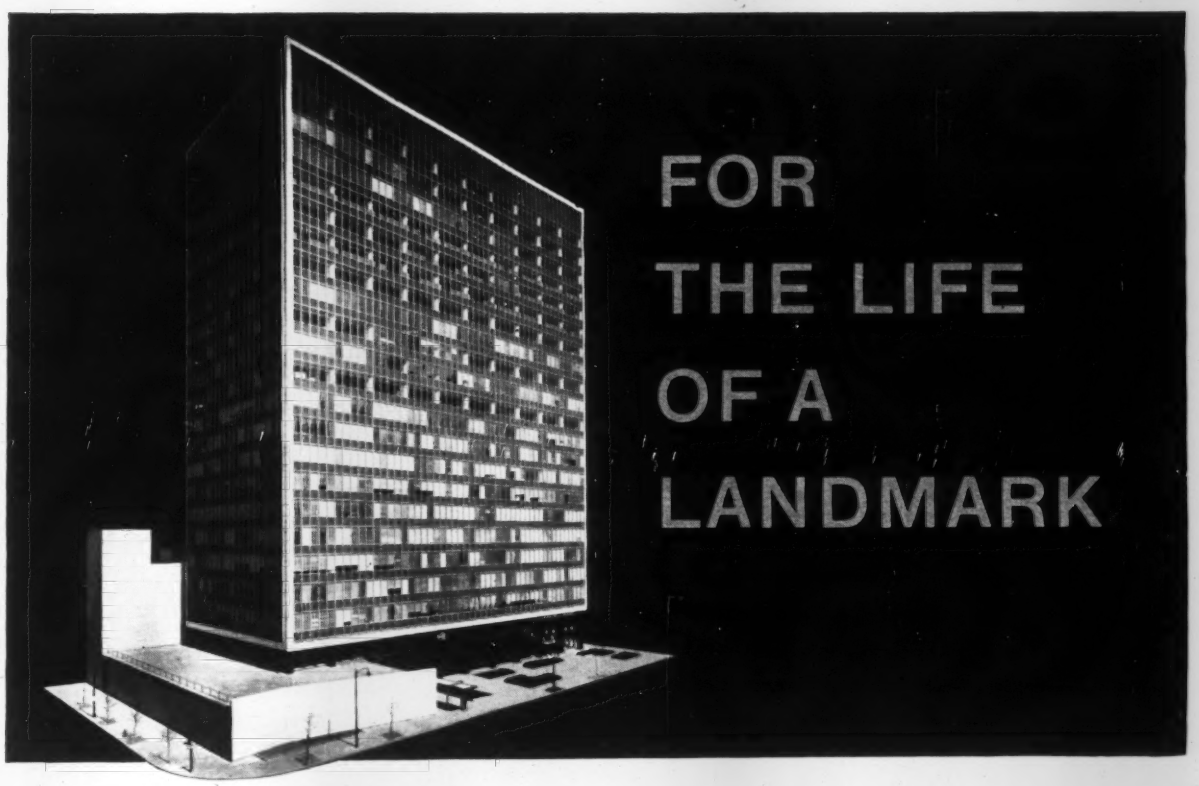
Air Pressures in Critical Areas Make Airtight Partitions Unnecessary

I appreciate Mr. Ries's observations ("Open for Discussion," August) regarding the flexibility of the system described in my article, *Four Sets of Conditions Demand Unusual and Flexible System* (June).

There is no necessity for absolutely airtight partitions between rooms due to the fact that air pressure in dustfree areas is always greater than in the clean area. Likewise, the pressure in the clean area is always higher than in the normal area. Therefore, if any exfiltration occurred, it passed from the dustfree area to the clean area, and from the clean area to the normal area.

The large number of diffusers in dustfree and clean areas prevent stratification and create the required turbulence. We have not encountered any stratification in the building. Temperatures and humidities are kept practically even throughout the entire area.

Boris M. Lemos
Consulting Mechanical Engineer



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See for yourself. For complete information on the immediate and long-term economies offered by Republic Steel Pipe, contact your local Republic distributor. Or, write to Republic Steel Corporation, Dept. HP-7664, 1441 Republic Building, Cleveland 1, Ohio.

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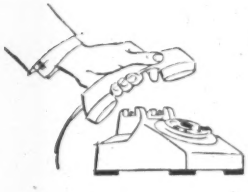

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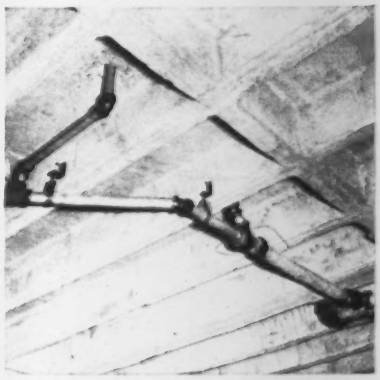


ILLUMINATING BUILDING PLUMBING SPECIFICATIONS called for 176 tons of 1½" to 12" galvanized steel pipe. Installation was handled by Gorman-Lavelle Plumbing and Heating Company, Cleveland, Ohio. Building architects were Carson & Lundin, New York.

REPUBLIC *Steel Pipe*

question of the month

"Will Redesigned Steam Header Using Same Welding Cap Be Safe?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. Other answers or comments for publication are invited.

"I am in the process of redesigning a 12 in., extra heavy, ASTM-A 106 Grade B steam header for steam at a pressure of 450 psi and at a temperature of 750 F. The header is to be lengthened.

"I plan to cut the present header at the cap weld, attach the required additional length of pipe, and use the same welding cap to close the new length.

"The header has been in service for about three years, intermittently. The temperature in the header has reached 800 F as the maximum during some of the cycles of operation.

"I would like to know if it is safe to use the end cap in this redesigned steam header. Also, what special precautions should be taken in the fabrication of this new header if it is safe? Would it be acceptable to weld the new length of pipe to the header where the former welding joint has been?"—J.G.

Yes, If Welding Is Properly Done and Duration of 800 F Service Is Short

J. G.'s INQUIRY obviously involves several considerations not covered in his specific question but which affect the answer for both the welding cap and the new pipe. Among these considerations are:

1) Can the cap weld be cut so as to leave sufficient welding neck for making a satisfactory re-weld? Obviously it would not be satisfactory to have the cap neck cut back to the dished section of the cap. Acceptable overall lengths for welding caps are prescribed in ASA Standard B16.9 for steel butt welding fittings. Suitable welding grooves will have to be restored before rewelding.

2) Does the field crew have suitable equipment, know-how, and skill to be trusted with a job of this kind? Cutting off the cap weld and rebeveling the welding ends of cap and header involve techniques different from those used in straight welding.

3) Is the present material actually suitable for the service conditions? A steam temperature of 800 F is in excess of that recommended for welded joints in carbon steel.

J. G. should be in a position to resolve considerations (1) and (2) for himself. Some further explanation of consideration (3) may be in order.

Graphitization in a welded joint is a function of the length of exposure time above some critical operating temperature. For serious graphitization to develop in a welded joint of A 106 Grade B carbon steel pipe at 800 F, several thousand hours' exposure probably would be required. Section 1 of the American Standard Code for Pressure Piping, ASA B-31.1-1955, has the following warning note over Table 2a on page 23:

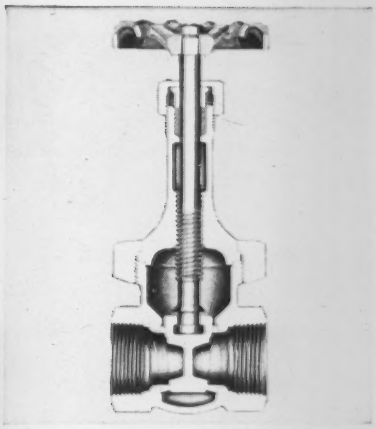
"Note: Where welded construction is used, consideration should be given to the possibility of graphite formation in the following steels: Carbon steel above 775 F; carbon-molybdenum steel above 875 F; chromium-molybdenum steel (with chromium under 0.60 percent) above 975 F."

The foregoing temperature ceilings represented the best judgment of the Code committee at that time. A new section just issued for petroleum refinery piping suggests a 750 F ceiling for carbon steel containing welded joints. In my personal opinion, 750 F operating temperature should not be exceeded with carbon steel in view of the huge expense and trouble involved if the welded joints in a line once start to graphitize.

This subject of graphitization in welded joints of carbon steel piping was well covered in the June 1959 issue of Heating, Piping & Air Conditioning by I. A. Rohrig in his article, *Carbon Steel Has Its Problems, Too; When Piping Steam at 800 F.*

J. G. says that the line has been in service intermittently at temperatures up to 800 F. If the future duration

Expanded-type body rings. Made from Crane Exelloy—a 12% chromium stainless steel. Provide a hard surface that resists abrasive damage, indentation and scoring by foreign matter. Rings are rolled in, can't work loose. Seating wear is taken by easy-to-replace bronze disc.



Quality in every detail inside and out. In rising and non-rising stem patterns—¼ to 3 inches—screwed ends. Working pressures: 200 lb. steam, 550° F.; 400 lb. non-shock cold water, oil, gas and air, 150° F.

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of exposure to 800 F is expected to be short, the tendency to graphitization probably can be ignored. In this case, carbon steel probably can be re-used safely. On the other hand, if long exposure at 800 F is expected, any new or replacement items should be of carbon-molybdenum or low chormium steel suitable for that temperature.

SABIN CROCKER
Piping Consultant

Welded Joints Should Be Heat Treated To Protect Against Graphitization

J. G. MENTIONS that the temperature in the header has reacned 800 F. Consequently, we must consider the fo'lowing:

1) Carbon steel is subject to graphitization at 800 F.

2) Welded joints in carbon steel piping that are subject to 800 F should be given high temperature heat treatment, i.e., normalized at 1700 F as a protection against the occurrence of harmful graphitization.

With these two facts in mind, let us proceed with the question regarding lengthening of the header. First of all, ASA B16.9, Steel Butt-Welding Fittings, Table 7, Dimension of Caps, tells us that the length of the cap must be either 6 or 7 in., depending upon the wall thickness. If the length of the cap is sufficient, I suggest that it be cut off at least ¼ in. outside of the present weld. By so doing, the present heat affected area and potential graphitization area will be removed. The pipe end from which the cap was removed should also be cut ¼ in. outside of the old weld to remove the previous heat affected area of the old weld. J. G. can then install the new pipe and re-use the cap, observing the requirements of ASA B16.9 for Steel Butt-Welding Fittings and ASA B31.1 Code for Pressure Piping (Section 1, I presume). Again, I would suggest normalizing the welded joints at 1700 F to protect against the harmful type of graphitization if the temperature of use will approach 800 F. If the temperature of use will not exceed 750 F, stress relief of the welds at 1100 F will be satisfactory. Consult the Code regarding stress relief.

I. A. ROHRIG
Materials Engineer
Generation Div.
General Engineering Dept.
The Detroit Edison Co.

Graphitization Should Be No Problem If 800 F Operation Is Intermittent

THE ANSWERS to the first and third questions in the last paragraph of J. G.'s inquiry are "yes" and "yes"—unless, of course, there are particular reasons, not stated in the inquiry, for suspecting that trouble could arise.

When dealing with carbon steel at high temperatures, graphitization is a possibility which springs to mind. It would not be difficult to submit a small sample to micrographic analysis to check this possibility. However, unless there are particular, unstated reasons to suspect graphitization, this does not appear necessary. Occasional operation at 800 F is consistent with a design temperature of 750 F (cf. par. 123 (b) of ASA B31.1-1955) and this design temperature lies below that for which a warning is made regarding graphitization (line below title of Table 2a, p. 23 of ASA B31.1-1955).

One should note the contents of par. 629 (a) of ASA B31.1-1955 in performing the operations. If machine preparation is contemplated, it might be more convenient to cut at some distance from the weld so as to afford a better opportunity of gripping the pieces. Backing rings should be used. Also, the degree of skill required for cutting, rebeveling, refitting, and rewelding is appreciably higher than that required for making a butt weld in ordinary construction with new components. The completed joints should be stress relieved at approximately 1100 F.

JOHN E. BROCK
Professor of Mechanical Engineering
U. S. Naval Postgraduate School

After Machining, Inspect Bevels For Stress Corrosion Cracking

IT IS acceptable practice to extend a vessel by cutting out the cap weld, inserting a spool piece, and re-using the cap.

Since stress corrosion cracking is a possibility in the type of service mentioned, the ends of the vessel and cap, after rematching of the bevels, should be inspected for cracks by dye penetrant or magnetic particle examination. If cracks are detected along the ends, further machining is required until all remaining evidence of cracks has been removed.

HELMUT THIELSCH
Metallurgical Engineer
Grinnell Co., Inc.

READER ASKS—

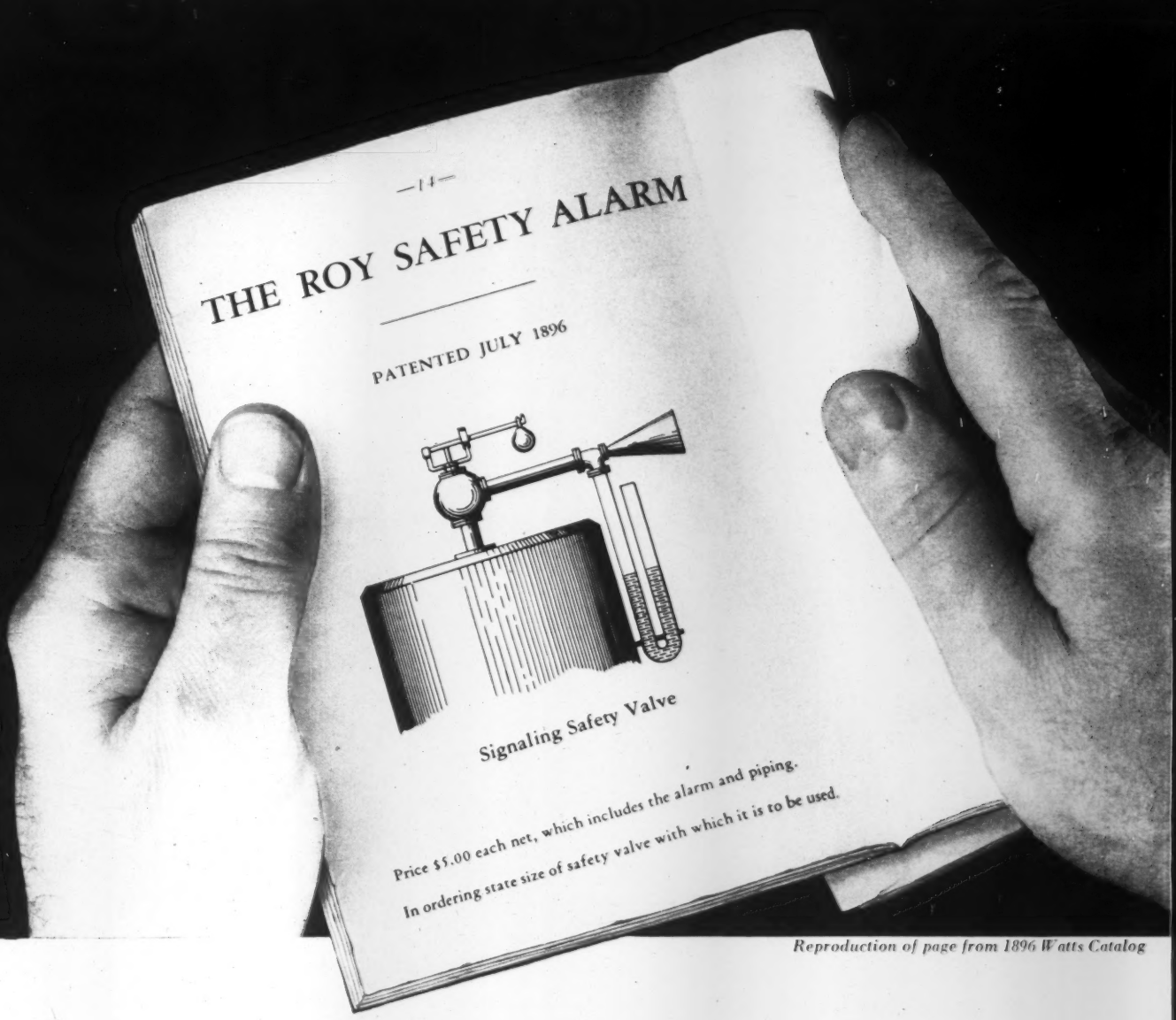
"How Can I Figure Supports For a Horizontal Tank?"

"How should I design the supports for a horizontal tank, 10 ft, 10 in. in diameter × 50 ft long?

"The vessel has been fabricated from ¼ in. thick steel plate and has dished heads. The tank is to be used for ammonia absorption and will be filled with water. The operating pressure will be 25 psi. The tank will be supported by concrete saddles.

"How far apart should I place the saddles. How many saddles should I use, without placing undue stresses on the shell?"—R.W.G.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*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For example, the Roy Safety Alarm (shown above) was patented in 1896 for extra insurance against accidents. Designed "for use on low pressure boilers or heating systems," this simple, ingenious invention shrieked a warning (by means of a horn or whistle) whenever excess steam pressure was generated, signaling that the equipment needed individual attention.

A crude device by today's standards, nonetheless it showed the company's *awareness* of the need for more complete control and safety.

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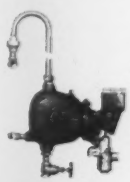
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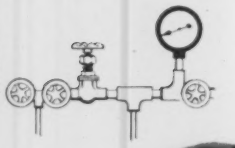
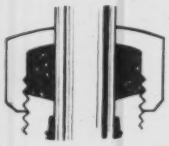


Stem is full ⅜" in diameter . . . equal in strength to specification valves.

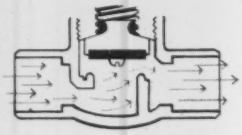
Packing chamber is big for positive sealing, long wear in constant use.

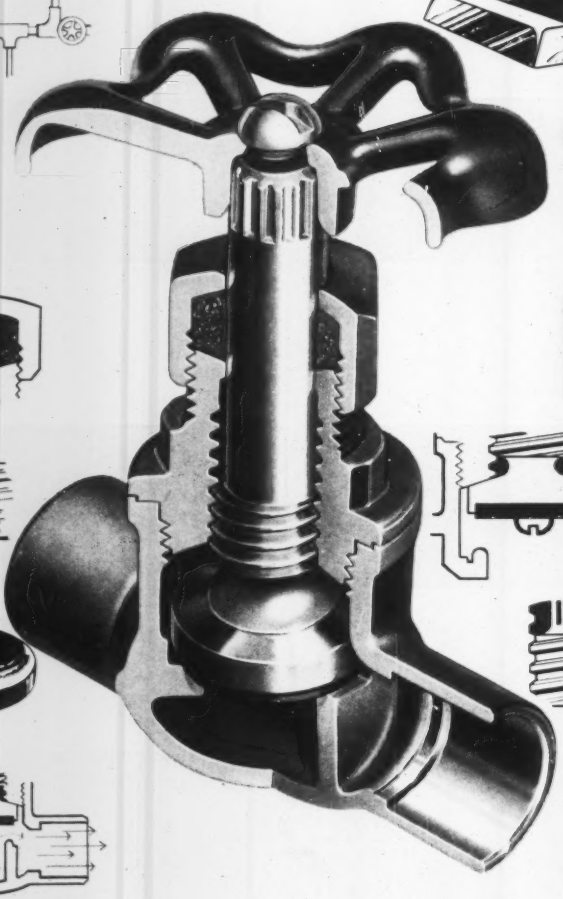


Precision machining eliminates need for bonnet gasket . . . a feature found only on pressure-rated valves.

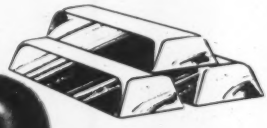
Buna-N, the most versatile disc known, is impervious to oil, gas or water. Provides more shut-offs per dollar.

Full flow design, original with NIBCO, delivers complete capacity of piping.





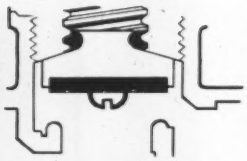
All brass parts are 85-5-5-5% red brass, the most corrosive-resistant brass alloy known.



Handwheel screw is stainless steel for easy removal.

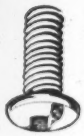
19 splines, instead of milled 4-point square, provide full holding power around complete circumference of stem.

Back seating feature permits re-packing under pressure . . . without leaking.



Double lead threads open valve in 1½ turns . . . 60° stub thread adds strength, longer useful life.

Stainless steel screw retains disc securely, yet removes easily because it is corrosive resistant.



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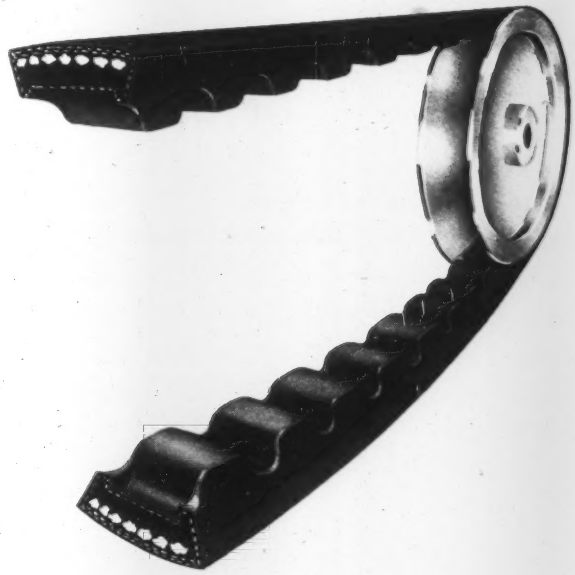

New R/M CX V-Belt Outlasts others as much as 8 to 1

Designers of heating and cooling equipment welcome the CX V-belt . . . *wherever* belt flexibility, ruggedness, small pulleys, and *extremely quiet* vibration-free running are important factors. This new Raybestos-Manhattan development is *the first and only fully molded, fully jacketed lugged belt* made for original equipment manufacturers. Extensive tests have proved it outperforms, outlasts other makes of belts as much as 8 to 1. Fully molded and full fabric cover prevents flex-cracking, maintains effective length *without* stretch to assure smoother, cooler, *quieter* running than ever before possible.

VIBRATION PROBLEMS—R/M engineering makes possible other improved V-belt designs to meet a variety of drive requirements. For example, R/M Full-Molded FHP V-Belts eliminate troublesome vibration and noise problems on air conditioners and similar units. An exclusive molding process positions *and controls* every belt part to assure balanced belt power delivery without whipping or slapping. It's the *one* V-belt fully engineered to assure vibration-free performance for every light duty drive application. For heavy industrial multiple belt units, Condor V-Belts assure *more* grip, *less* slip . . . longer, trouble-free belt service. Now transmit 40% more power than conventional V-belts at no increase in cost.

R/M POLY-V* DRIVE—For heavy duty power transmission requirements, *no* drive delivers as *much* power in as *little* space as R/M's patented Poly-V* Drive employing a *single*, parallel V-ribbed Poly-V belt. Write for Bulletins.

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For air conditioning blowers, pumps, compressors and other heating and ventilating units, R/M Rubber Expansion Joints are precision engineered to overcome expansion stress, insulate against the transmission of destructive vibration and disturbing noises. Advanced engineering features and highest standards of production quality assure these additional advantages:

- **Maximum Resistance to Shock**
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- **Abrasion and Corrosion Resistant**

On pipe lines subject to noise and vibration, Condor Flexible Rubber Pipe outlasts iron or steel . . . permits easy installation and eliminates leaky joints at bends. Write for Bulletin M685.

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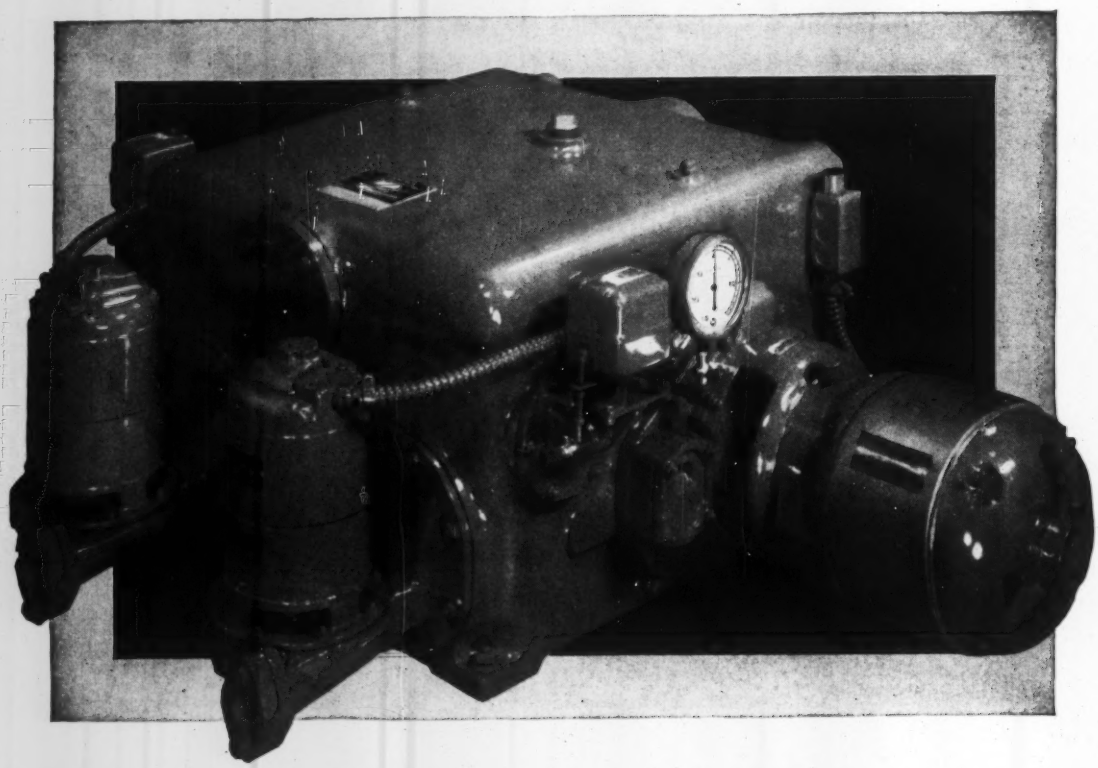

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These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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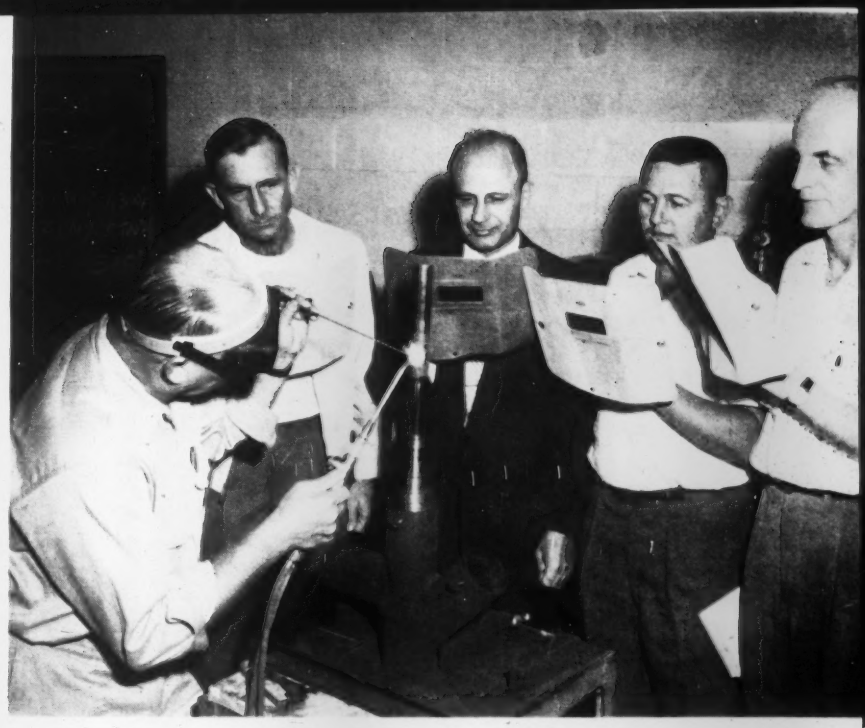


OXYACETYLENE WELDING procedures were demonstrated in classroom session by James A. Howery. Fixture which holds pipe being welded has been designed for holding pipe in vertical, 45 deg, and horizontal positions to assist in teaching apprentice pipefitters correct methods and safe practices

UA Instructors Embark on 5-Year Plan

. . . at sixth annual apprentice instructor training course, to keep pace with needs of HPAC industry

A NEW five-year curriculum for pipefitter apprentice instructors was initiated this year by the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry as a part of its apprentice instructor training program, held annually at Purdue University.

Each year, under UA sponsorship, apprentice pipefitters and apprentice instructors meet at Purdue — the apprentices to display their skills for cash prizes, and the instructors to keep abreast of the latest technological advancements in pipefitting and to learn how to teach them. The two events combine to contribute to the general upgrading of this vital facet of the heating, piping, and air conditioning industry.

The sixth such session was held on August 10 to 11. For a report of the apprentice contest, see pages 49 and 50.

Under the new curriculum, instructors will attend these brief summer sessions for five years. The course has been planned to provide the apprentice instructor with a number of detailed courses which will terminate with a certificate being issued by Purdue if completed satisfactorily.

This year, 327 attended the class sessions. Instructors from industry conducted technical sessions in which the fundamentals of welding, pneumatic controls, steam and hot water heating, and refrigeration were taught.

Staff members from the Purdue Industrial Education Dept. taught such instruction techniques as how to teach applied mathematics, how to prepare reports, and how to encourage students to learn. *Industrial Safety with Relation to Atomic Radiation*, a new course introduced this year, was taught by representatives of the Atomic Energy Commission.

Study Brazing, Soldering

Correct procedures for silver brazing and soft soldering were taught by James A. Mehaffey, Stanley G. Flagg & Co. He explained the importance of matching the same types of copper tubing with their respective fittings and how the color coding system used now aids in identifying the various types. He listed the color coding system as follows: (1) Type K copper tube, green; (2) Type L copper tube, blue; (3) Type M copper tube, red; (4) copper drainage tube (DWV), yellow; and (5) threadless pipe (TP), gray.

Mr. Mehaffey outlined the steps necessary to prepare joints for brazing and soldering:

1) Cutting and fitting

a) Cut to the correct length. Ends should be cut square.

b) Ream the tube and remove any burrs.

c) Check for proper fit. If too tight, brazing alloy or solder cannot enter the joint. If too loose, capillary action will be lost.

2) Cleaning

a) Surfaces to be joined should be free from oil, oxides, and dirt, for proper adherence.

b) The tube should be cleaned slightly more than the depth of the cup of the fitting.

3) Fluxing

a) Flux should be of paste-like consistency.

b) Apply flux evenly with a brush to all cleaned surfaces.

c) Avoid excessive flux inside pipe.

4) Assembly and support

a) Immediately after fluxing, insert the tube into the cup of the fitting and be sure it is hard against the stop at the bottom of the socket.

b) Rotate the tube a full turn to distribute flux evenly.

c) Arrange supports so that the assembly will be aligned without restricting expansion and contraction and so that no strain will be placed on joints during brazing and cooling.

For soldering, Mr. Mehaffey made these recommendations:

1) Soldering operation

a) The flame from an LP gas torch, and acetylene torch, or a gasoline blow torch should be applied on the fitting. It should be pointed toward the tube, keeping it in motion to heat a large area.

b) When the joint is hot enough, the end of the wire is touched to it, and the solder will melt on contact and be drawn in by capillary action.

c) The flame should *not* be applied directly on the solder.

d) If the joint has been properly made, a ring of solder will be observed all the way around the joint.

e) Most of the surplus flux and solder can be removed with a cloth or brush while the joint is still hot.

2) Cleaning the joint

a) After the solder has set, the joint can be wiped clean with a wet cloth.

b) If a hydrostatic pressure test shows defective joints, it is best to dismantle the joint and clean it, apply flux, and resolder.

Brazing also follows an organized procedure, as explained by Mr. Mehaffey:

1) Brazing operation

a) The oxyacetylene torch should be adjusted to produce a low flame.

b) Heat the entire circumference of the pipe about 1 in. to 1½ in. from the face of the fitting. The flame should be directed at the center of the pipe and slightly away from the face of the fitting. Continue to apply heat to the tube until the flux becomes a clear fluid. This indicates a heat of about 1100 F has been reached.

c) At proper heat, switch the flame to the cup of the fitting and follow the procedures used on pipe.

d) When the flux is clear on both pipe and fittings, apply the alloy firmly against the pipe at the face of the fitting.

e) Heat the cup of the fitting where the alloy is being applied. Additional heat is required at the base of the cup for complete penetration. When a segment of the joint is finished, move to the next section. When completed, a continuous fillet should be visible around the entire joint.

2) Cleaning and examination

a) Residual flux should be removed with warm water for visual inspection and hydrostatic pressure testing.

b) If the alloy did not flow properly, it may be due to dirty metals, incorrect clearances, or improper heating.

Mr. Mehaffey stressed the importance of testing brazing and soldered joints hydrostatically. With this test the flux will wash away from an improperly made joint. He said that air testing these joints is not worth the trouble.

Demonstrate Use of Pipe Tools

The proper use of pipe tools was discussed by James E. Butler, Ridge Tool Co. He explained the principles of pipe threading and why the taper thread is used to prevent leaks in joined pipes carrying fluids. A sealing compound must be used, he said, but the threads must also be cut with sharp dies to make a tight joint.

Mr. Butler pointed out that chipped dies and rough or out-of-round threads often result when an inferior grade of pipe is used. He also stressed the need for proper lubrication of the die when threading quality pipe to prevent excessive die wear and uneven threads.

He emphasized the importance of cutting the pipe ends square to assure good threads. If the pipe collapses during threading, he said, it is the result of a weakened pipe wall and can be caused by reaming prior to threading.

Teach Oxyacetylene Welding

The basic rules for safe handling of oxyacetylene welding equipment were presented by James A. Howery, National Cylinder Gas Div. of Chemetron Corp. Every pipefitter apprentice and journeyman should be thoroughly familiar with these rules before starting to weld, he said. These rules are:

1) Open the oxygen and acetylene valves slowly.

2) Purge both the oxygen and acetylene hose lines before lighting the torch.

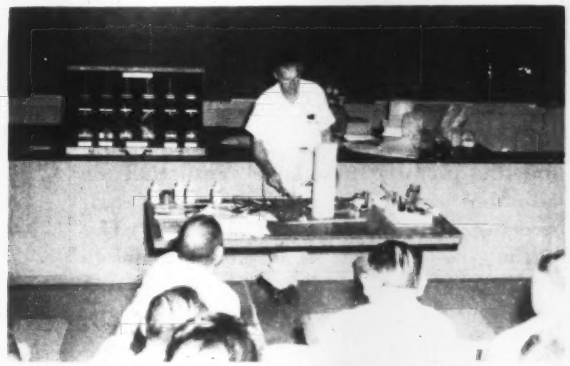
3) Keep the oxyacetylene equipment in good condition — free of oil, clean, and with no leaks.

4) Always wear goggles with proper filter lenses.

In preparing for welding, Mr. Howery suggested that gas be bled from the regulator by opening the corresponding torch valve and engaging the regulator adjusting screw. This should be done before opening the cylinder or manifold valve. Then, the adjusting screw should be completely released. He suggested that all cylinder valves be opened slowly and explained that the acetylene cylinder valve should never be opened more than 1¼ turns. However, the oxygen cylinder valves should be opened fully.

Mr. Howery demonstrated how to hold the torch and adjust the flame, how to make a tack weld and a butt weld, and how to join two pieces of pipe. He stressed the importance of cleaning the tips with smooth round cleaners only — not drills, because the sharp edges will damage the torch orifice.

Instructors arm themselves with technical, educational know-how



SILVER BRAZING, SOFT SOLDERING procedures were taught by James A. Mehaffey. Here, he shows apprentice instructors how melting points of various fluxes can be demonstrated. Bricks hold thin piece of metal with fluxes spread on top. When heat from torch melts flux, students can readily visualize proper time for joint to be made in actual practice

THREADING 6 IN. PIPE with power drive is demonstrated here by John Meese, left, and James E. Butler during instruction on use of pipe tools. They stressed the importance of keeping pipe dies clean, sharp, and adequately lubricated to insure that threads are cut properly. Pipe ends should be cut square, he said, to facilitate good threads

Joining Plastic Pipe

Installation and joining procedures for plastic pipe and fittings were taught by Harold Watts, Tube Turns Plastics, Inc. He pointed out the importance of naming the specific type of plastic pipe — polyvinyl chloride (PVC), kralastic, or polyethylene. These have wide ranges of pressure and temperature limitations, so it is therefore imperative to clearly specify which one. He suggested that manufacturers' literature be consulted for these limitations and for the basic knowledge of the various plastic materials necessary in order to join the pipe and fittings by threading, solvent cementing, or welding.

When threading PVC pipe, Mr. Watts suggested, a mandrel should be inserted in the pipe to keep it from getting out of round. Also, sharp dies should be used so that cracks do not develop. If automatic threading equipment is used, the speed should be slow and oil or water should be used to keep the dies cool. Care should be taken not to notch the pipe during threading. Joint threading should be done slowly to keep from generating excess heat which will expand the joint and cause it to leak.

Mr. Watts emphasized the care necessary to complete leakproof joints in plastic pipe. He pointed out that a higher degree of workmanship is required: the ends must be square; the correct number of turns must be taken.

In discussing solvent cementing of PVC socket joints, he suggested several precautionary measures to be sure a joint is tight:

1) The ends of the pipe should be cut square and all burrs removed.

2) Apply an ample amount of solvent cement to permit an overflow on the outside after the joint has been assembled. This will guarantee that all surfaces are covered.

3) Give the joint one-quarter turn after assembly to give it a wiping action before allowing it to set.

What if a leak develops at a socket joint? Mr. Watts suggested that a collar or ring be added around the pipe next to the joint. This, in effect, extends the socket. The collar should be cemented to the pipe and allowed to set before leak testing. He said that most leaks can be corrected in this way, but that the collar will not increase the strength of the joint.

Turning to the subject of welding PVC pipe, Mr. Watts explained that the process was really one of fusion rather than welding. The torch consists of a hose to deliver compressed air at a pressure of 4 to 5 psi and an electric cord which is connected to a heating element in the torch. A molten plastic bead is formed when the hot gas from the torch heats the plastic rod at the joint. He said that some engineers and contractors feel it is good insurance to back-weld all threaded and solvent cemented joints, but that this is not necessary if the workmanship is good.

Teach Refrigeration Cycle

Fundamentals of the refrigeration cycle were presented by Robert Neidermeier, Sporlan Valve Co. He covered the pressure and temperature relationships of refrigerants and how the various refrigerants react to different conditions. To illustrate the cycle, a glass piping system with all component parts (see the front cover of this issue) was used to show several conditions that occur by adjusting one or more valves. In this discussion, he included the thermostatic expansion valve — what it does and where the bulb should be located in order to achieve dependable service from air conditioning equipment. ≠

Weigh Odor Control Methods Carefully

• To eliminate or abate an odor condition in an air conditioned space it is necessary either to remove the offending gases or vapors or reduce their concentration. Sources of odors are many, and detection and measurement must ultimately rely on human appraisal. Odors are affected by temperature and humidity. They may not only be objectionable to the sense of smell, but may also cause irritation to the nose and throat. Some of the physical methods for removal are by ventilation with outside air, air washing or scrubbing, charcoal adsorption, and masking. Chemical absorption or destruction of odor sources, vapor neutralization, masking, and catalytic combustion are other means. For a given building the quantity of outside ventilation air admitted should be in accord with engineering standards and local codes. The author presents an example of possible economies and comparative investment and operating costs of an outside air system and a recirculating air system.

Warren Viessman, a graduate of Johns Hopkins University, has had extensive experience in air purification and protective shelter applications. He is a member of the ASHRAE research advisory committee on odors, and chairman of its subcommittee for publication of a section on odors in the 1960 Guide.

BY WARREN VIESSMAN
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AIR CONDITIONING is defined in the Guide as "the process of treating air so as to control simultaneously its temperature, humidity, cleanliness, and distribution to meet the requirements of the conditioned space." This brief definition could be expanded to more fully cover the quality of the air. The definition implies an odorfree condition as a component of cleanliness.

Odor is defined as that property of a substance which excites the sense of smell. To be odorous, a substance must be either already in a gaseous or vaporous state, or possess a vapor pressure. When the concentration of odorous vapors in the air is insufficient to permit odor perception, the air is commonly said to be odorfree. Therefore, to eliminate or abate an odor condition, it is necessary either to remove the offending gases or vapors or adequately reduce their concentration.

The sources of odors resulting in discomfort to individuals in occupancy areas are many. In offices, arenas, and other enclosed spaces, obnoxious smells may be body and tobacco smoke odors. Cigarette smoking may produce objectionable pyridine and ammonia odors and irritants as well as impair visibility. Discomforting and toxic odors may be introduced from the outside atmosphere that contain a high percentage of hydrogen sulfide, industrial effluents, or smog.

In industrial spaces the air may contain chemical and product odors such as printing ink, dyes, synthetics, and odors from manufactured rubber products. Odors may be contributed by linoleum, paint, upholstery, rugs, drapes, etc. Food, cooking, and putrefaction of animal and vegetable matter are also frequent contributors. Odors can also occur from air conditioning coils, as the metals and coatings used materially affect the likelihood of producing objectionable odors.

Your Nose Is Best Judge

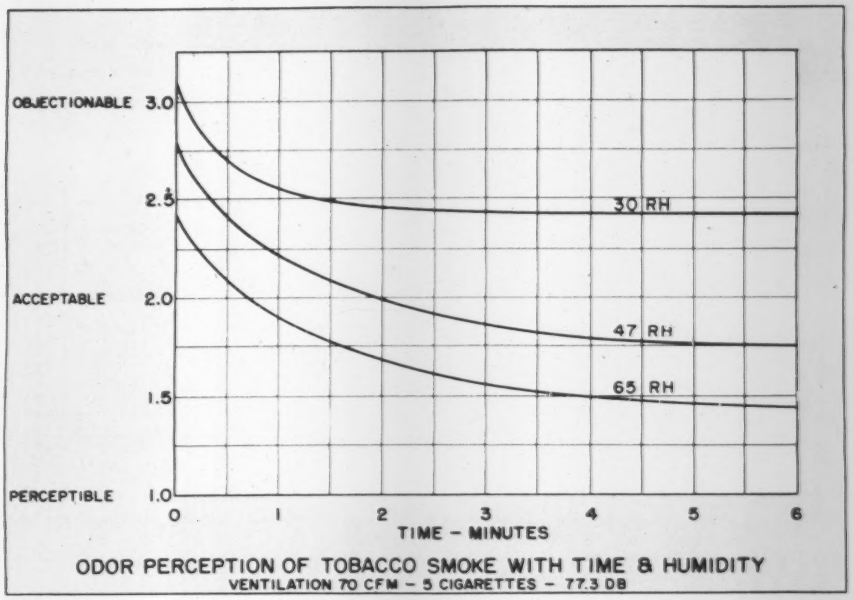
Odor detection and measurement must ultimately rely upon olfactory observations and human appraisal. A trained organoleptic panel is presently the best method of evaluating odor intensities, as the nose is still the best instrument for odor perception. An arbitrary preference scale of increasing odor values is selected.

A sensory scale utilized for cigarette smoke classifies odor as: zero, imperceptible; 1, not objectionable; 2, acceptable; 3, objectionable; 4, endurable; and 5, intolerable. This scale has been found convenient for use in air conditioning odor investigations. As discrimination develops with experience, the objective sensory scale can be divided into more steps.

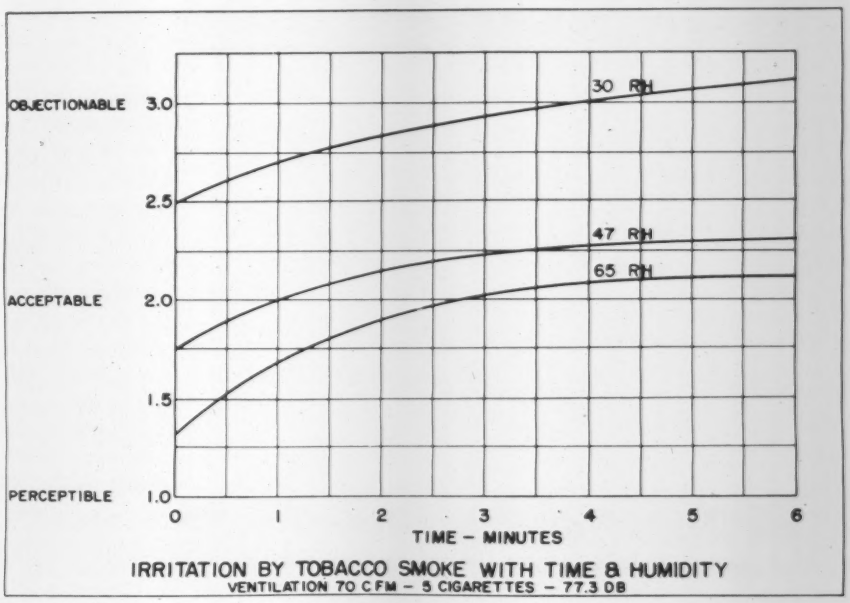
Another method bases odor intensities on multiples of threshold concentrations. In this method, a source of odorless air and a method of mixing it in easily variable proportions with the odor sample is used. The mixture is adjusted until the odor can be barely discernible. The result, expressed as the ratio of mixture volume to sample volume, is given as the number of thresholds.

At threshold, or just discernible intensity, the nose is

This article is based on a paper presented at the recent Air Force air conditioning conference at Wright-Patterson Field. It has been made available for publication by Mr. Viessman.



1 ODOR PERCEPTION intensities are related to time and relative humidity. Curves, based on tests using cigarette smoke, indicate that perception is affected by adaptation to odor intensity. Adaptability begins immediately, takes place more rapidly during initial stages of exposure



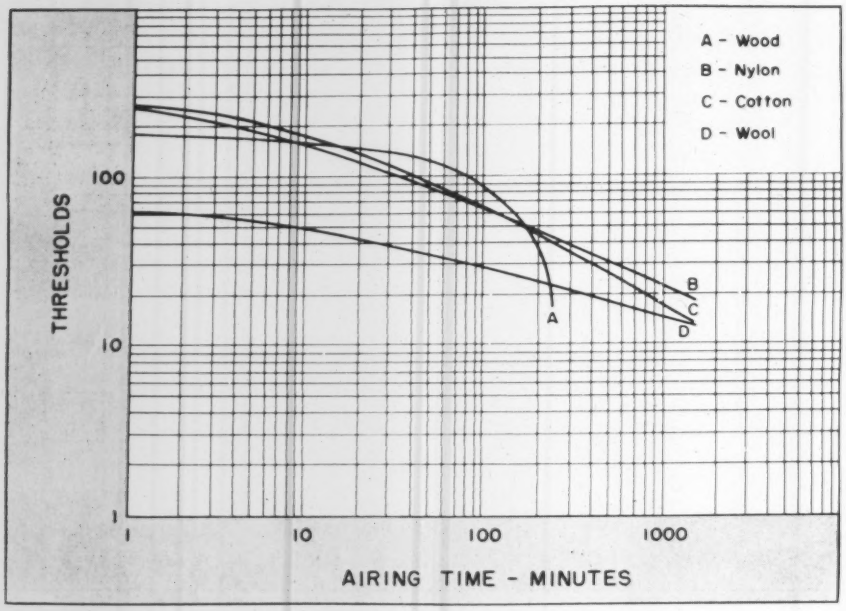
2 WHILE PERCEPTION of tobacco smoke falls off rapidly, irritation to nose and eyes generally increases with time. Note that irritation is greater at lower relative humidities

operating at its most sensitive point. The number of thresholds has a useful meaning. For instance, 10 thresholds has the implication that 1 cu ft of odorous gas can taint 10 cu ft of air to a recognizable level.

Odors may not only be objectionable but may cause irritation. Tests made by organoleptic panels have indicated that first inhalation or impressions of cigarette smoke have, in the majority of cases, been higher than second or later inhalations. This indicates that perception is affected by adaptation to odor intensity. Adaptability begins immediately and takes place more rapidly during the initial stages of exposure.

Perception intensities have been determined as a function of time. A smooth curve indicating trends has been developed from test data and is given in Fig. 1. In the case of irritation, which is confined mostly to the eyes and nose, irritation has been found to increase with time, approximately as shown in Fig. 2.

Research has indicated that odor perception of cigarette smoke (suspension of tobacco tar droplets plus vapor) and pure vapors are affected by temperature and humidity. An increase in humidity at constant dry bulb temperature has the definite effect of lowering the intensity level of cigarette smoke as well as of pure vapors. This is shown in Fig. 1. The effect is more pronounced for some odorants than for others. An increase of temperature at constant specific humidity lowers the odor level of cigarette smoke slightly. While the perceptible



3 ODOR ADSORPTION and release rates for several materials have been recorded as shown here. Adsorption at end of 24 hr charging period was about same for nylon and cotton at same temperature and humidity

odor level of cigarette smoke decreases with time of exposure, irritation to the eyes and nose generally increases. The irritation is greater at lower humidities.

In order to keep odor perception and irritation at a minimum, the air conditioned space should be designed for about 50 to 55 percent RH. Since temperature has but slight effect on odor level at a constant specific humidity, it can generally be ignored and the temperature maintained for the desired conditions.

Tests have been made on the odor adsorption and release of environmental materials such as wool, nylon, rayon, and fir wood. It was determined by using isoamyl acetate as the odor agent that the odor adsorption of rayon was negligible. It did not adsorb enough odorant to be measured by the test methods employed. The odor adsorption at the end of a 24 hr charging period was about the same for nylon and cotton at the same temperature and humidity, as shown in Fig. 3.

Odor adsorption of wool samples under the same test conditions was less. Adsorption of the wood samples was less than nylon and cotton, but more than wool. At 50 percent RH, maximum odor adsorption during the 24 hr loading period occurs at about 75 F for nylon, and is considerably less at 60 F and 90 F, as shown in Fig. 4. At 75 F, odor adsorption during the same period was greater at 50 percent RH than at 85 percent RH.

Odor retention or release as a function of airing time is affected by temperature and humidity. For the fabrics tested and for 75 F, 50 percent RH conditions, odor retention after 1000 min. was reduced to 6.8 percent for cotton, 12.3 percent for nylon, and 25.8 percent for wool. In the latter case the initial wool retention was only about 25 percent of that for cotton or nylon. After 1000 min. the odor retention of wool was favorable to that of cotton. Wood lost its retention after 300 min.

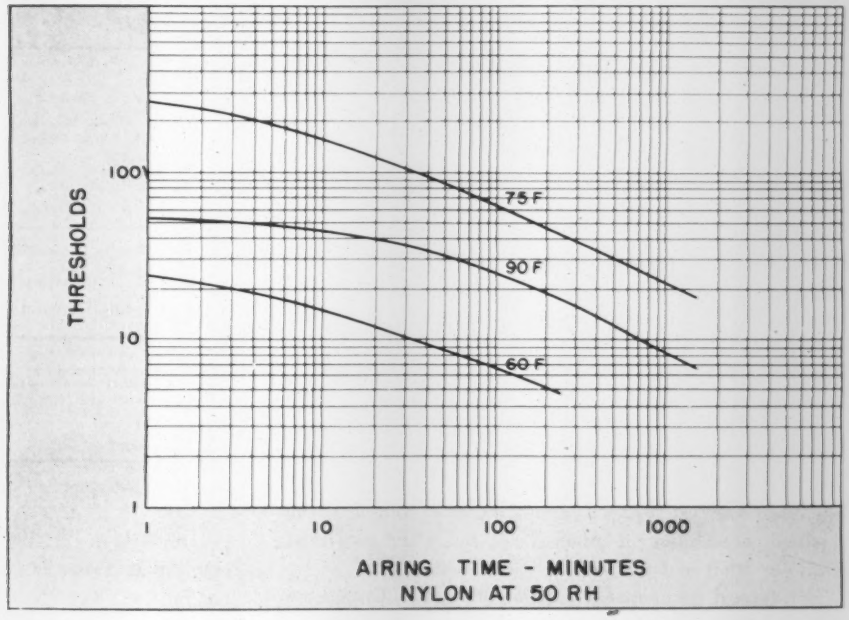
This data is meager, but indicates a trend useful for design. Application of the quantitative values should not be made without due consideration to the finish, weight, weave, and thread count of the fabrics. Further research is needed relative to these items. On a qualitative basis, wood quickly gives up odors adsorbed. Wool has low odors from a tobacco smoke filled room and releasing binations tested. Nylon and cotton adsorb large quantities of odors at an optimum condition of 75 F and 50 percent RH. They act as a sponge, readily adsorbing odors from a tobacco smoke filled room and releasing them more slowly over a longer period. This indicates that the selection of drapes, floor coverings, etc., are important air conditioning considerations.

While it has been shown that smoke, cooking, and body odor perception is decreased with humidity increase, where the odor source is intrinsic with the materials, as in the case of linoleum, paint, rubber and upholstery, a reduction of relative humidity would be beneficial, as this would decrease the rate of odor release.

How to Remove Odors

Odor removal can be accomplished by physical or chemical means. Ventilation with clean outside air, air washing or scrubbing, charcoal adsorption, and masking are physical methods available to the engineer. Chemical absorption of odor sources, vapor neutralization, masking, and catalytic combustion are other means.

Of these, air washing or scrubbing and combustion are processes of considerable value to process industries. Washing and scrubbing, like filtering, are applicable to the removal of particulates and, in some cases, are means of valuable product recovery. Where odors are associated with the particulates, they are indirectly removed.



4 AT 50 PERCENT RH, maximum odor adsorption during 24 hr loading period occurs at about 75 F for nylon, and is considerably less at temperatures of 60 F and 90 F

Combustion of obnoxious gases is quite efficient and practical where indicated by economy. These methods are employed to alleviate the effects of harmful exhaust gases and particulates on health, vegetation, and property. Ventilation and charcoal adsorption are effectively and extensively utilized in air conditioning for odor removal by the air conditioning engineer.

Ventilation is effective in removing the contaminated air in an enclosed space by logarithmic dilution. In this process, the vitiated air containing objectionable gaseous odors, irritants, particulates that obscure vision, and toxic matter are replaced by outside air.

Ventilation requirements for human occupancy are a function of the space per person and the activity. Such data is presented in a readily usable form in Fig. 5. The data of Curve D applies reasonably well to densely populated, heavy smoke laden atmospheres, such as at sports arenas where vision and irritation are more of a problem than odor. It has been determined that 30 cfm per person provides effective ventilation for such arenas to avoid objectionable eye irritation, odors, and impaired visibility.

For unusual or special problems, ventilation rates provided by regulations, the Guide, or local codes should be considered as applicable.

The actual oxygen requirement per person varies with activity. It is normally about 0.39 cfh per man when walking at the rate of 1 mph. About 0.74 cu ft of carbon dioxide is liberated per man-hour for normal activity. Air normally contains about 0.03 percent carbon dioxide. Fig. 6 shows the effect of carbon dioxide on lung action. A concentration of 0.6 percent has little effect on lung action, increasing it only about 10 percent above normal.

As is shown in Fig. 5, the oxygen and carbon dioxide requirements can be met with an outside air ventilation rate less than 1 cfm per person. A ventilation rate above 4 cfm is required to dilute odors, irritants, smoke density, or other nontoxic conditions.

The amount of ventilation required per person to remove odors or dilute them to an acceptable value can be determined directly from Curve D of Fig. 5. Use of this curve is very effective for limited outside air ventilation.

Smoke and other solid and liquid particulates can be effectively removed by electronic precipitators or submicron particulate filters. A filter of the desired performance is a requisite for most all ventilation systems. Odors, gases, and vapors can be removed effectively by charcoal adsorbers or by counteraction. In cases where the room is conditioned during summer or winter, considerable fuel and power saving can usually result from use of these methods, rather than by high ventilation rates.

Charcoal Cures Odor Problems by Adsorption

Charcoal adsorption is defined as the physical condensation of the sorbate (gas or vapor) on the sorbent (charcoal). The charcoal or carbon is especially prepared from cocoanut shells, peach kernels, or other materials.

To increase the surface area and thereby increase the sorption capacity, the charcoal or carbon is activated. Cocoanut charcoal, properly activated, is considered the standard high quality material for air or gas purification in air conditioning systems. The quality of charcoal as an adsorber of gases is rated on the break-through time when subjected to the accelerated chloropicrin test.

The capacity of charcoal to adsorb gases or vapors varies with the gas or vapor. Some are readily adsorbed, while others are not. Improved adsorption for certain gases, including some poisonous gases, can be obtained by impregnating the charcoal with certain mineral salts.

Activated charcoal has high adsorbent capacity for

TABLE 1 — VENTILATING DESIGN CONDITIONS for Washington, D. C., are listed below. Data is applied to Tables 2 and 3 in making cost comparisons of systems using outside air *vs* recovered air

Season	Ventilation air, cfm	Outside conditions: Temperature, F DB	Outside conditions: Temperature, F WB	Outside conditions: Enthalpy, Btu per lb of dry air	Inside conditions: Temperature, F DB	Inside conditions: Temperature, F WB	Inside conditions: Enthalpy, Btu per lb of dry air	Difference in enthalpy, Btu per lb of dry air	Heating deg days	Heating days	Heating hrs	hrs Cooling
Summer	1000	95.0	78.0	41.6	80.0	66.8	31.5	10.1	....	...	....	810
Winter average	1000	45.5	40.5	15.5	73.0	61.0	27.2	11.7	4300	220	2200	....
Winter maximum	1000	10.0	9.0	3.5	73.0	61.0	27.2	23.7	4300	230	2200	....

body odors, tobacco smoke, and most odor causing substances. One lb of charcoal takes up about 20 to 50 percent of its own weight. Activated charcoal will not satisfactorily remove carbon monoxide or carbon dioxide.

If analytical determination or knowledge of specific odor causing compounds and their amounts are not available, other means can be employed to determine the charcoal requirements. These may be an inventory of individual odor sources, type of occupancy and volume to be purified, or dilution of purified air, using the curves of Fig. 5 or other means.

For typical occupancies, 1 lb of 50 min. activated cocoanut shell charcoal will purify for one year 2000 cu ft in dwelling and barracks buildings, 800 cu ft in auditoriums, offices or restaurants, 300 cu ft in hospitals, conference rooms or schools, and 100 cu ft of air raid shelters or animal rooms. If 40 min. charcoal is to be used, the amount of charcoal required would be 20 percent greater.

Charcoal's Effectiveness Stops at 125 F

The physical removal of odors by activated charcoal is limited to air temperatures not over 125 F. Since usual objectionable odors are combustible and can be destroyed by burning, combustion processes are employed for odor destruction in higher temperature gases. Where it is desired to remove odors from industrial exhausts at temperatures above 125 F, the gases can be flowed over a catalyst at about 500 F and be destroyed by catalytic combustion. For higher temperature gases, direct combustion at temperatures of 1200 F and above are employed to destroy odors by passing them through a furnace to the exhaust stack.

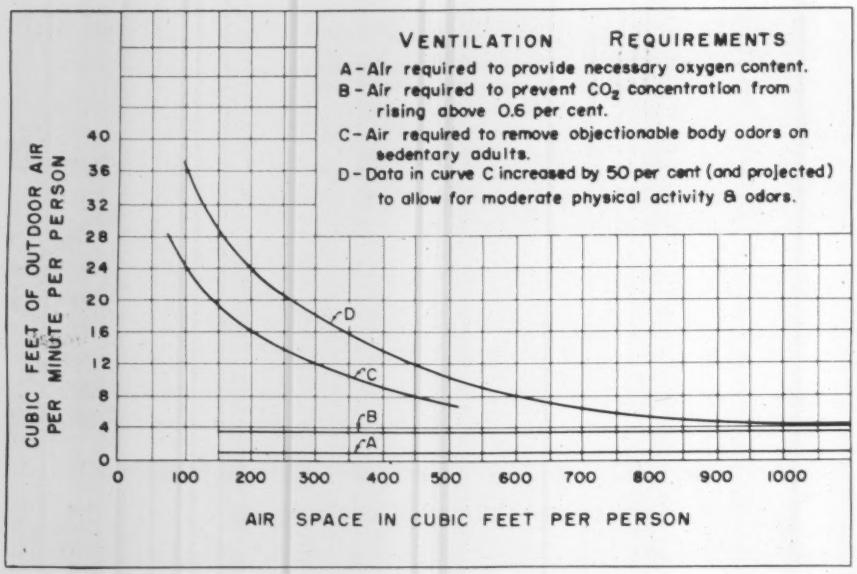
TABLE 2 — EQUIPMENT CAPACITIES and first costs per 1000 cfm, based on design data listed in Table 1, given below

Air equipment	Capacity determination	Capacity	Unit costs	Cost: Outdoor	Cost: Recovery
Cooling	1000×10.1/2667*	3.8 Tons	$300.00	$1136.00	
Heating	4.5×1000×23.7/1000	106.3 MBtu	4.00	426.00	
Recovery		1000 cfm	350.00		$350.00
Total first costs				$1562.00	$350.00

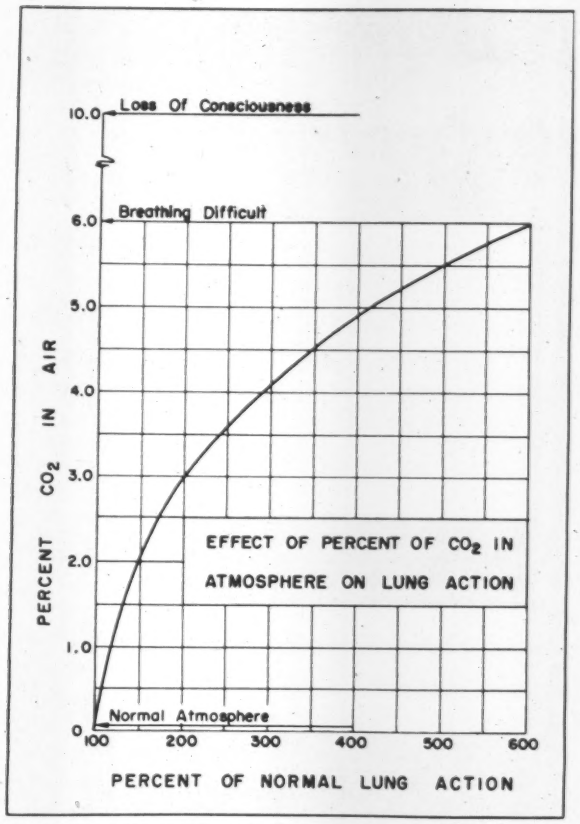
*Conversion factor.

Activated charcoal is available in cylindrical canisters, flat plate or accordion pleated frames. They can be reactivated at a temperature of about 1000 F in some cases. The adsorbers are provided with a fan system for recirculation or placed in the return air stream of an air conditioning system. If a percentage of the return air is purified, the outside air requirement, as indicated in Fig. 5, could be reduced accordingly, without affecting the odor level and with a saving in costs.

Four cfm of outside air would still be required to supply oxygen and to prevent the carbon dioxide concentration from exceeding 0.6 percent. In cases where no out-



5 VENTILATION REQUIREMENTS for human occupancy depend on amount of space per person, type of activity within space. Curves at left present this data in readily usable form as valuable tool for engineers



6 OXYGEN REQUIREMENTS per person varies with activity. Effect of carbon dioxide on lung action is shown here

side air can be provided, oxygen can be provided and the carbon dioxide adsorbed.

For a given building the quantity of outside ventilation air supplied should be in accord with acceptable engineering standards, regulations, and codes. If the installation is to be operated summer and winter, the hours of operation and outdoor and indoor design conditions must be known if the air is to be cooled or heated. The Chicago ventilation code specifies not only the total circulated ventilation air for various occupancies, but also stipulates that one-third of the code requirements shall be taken from outside if this air is tempered and filtered. It also stipulates that, when effective adsorption devices are employed, not less than 15 percent of the code requirement shall be taken from the outside. This is a very useful guide to the designer in setting up an adequate ventilation system with or without charcoal adsorbers.

Outside Air *vs* Recovered Air

As an example of possible economies and comparative costs of outside air *vs* recovered air, 1000 cfm is considered as a basis for a location having climatic conditions similar to Washington, D. C. Design conditions are given in Table 1 and investment of first costs in Table 2.

Owning and operating costs are given in Table 3. Utility costs are those prevalent at large installations.

TABLE 3 — ESTIMATED DIFFERENTIAL of owning and operating costs, outdoor air *vs* recovery air for 1000 cfm, are as follows, based on Tables 1 and 2

	Item		Outdoor air	Recovery air
	Annual fixed charges			
1)	Amortization, 20 years, cost per year		$ 78.10	$ 17.50
2)	Interest rate, 4 percent: [(20 yr + 1)/(2 × 20 yr)] × 0.04 × initial cost		32.00	7.35
3)	Taxes and insurance (neglected)		0.00	0.00
4)	Total annual fixed charges		110.10	24.85
	Annual maintenance costs			
5)	Repairs, refrigerating equipment	$1.20 per ton	4.56	
6)	Refrigerant	0.44 per ton	1.67	
7)	Oil and grease	0.12 per ton	0.46	
8)	Repairs, heating	gross	5.00	
			11.69	
	Annual service costs			
9)	Electric power, refrigeration (0.746 × hp × cooling hours)/e* = 8220 kwhr			
10)	Cost of electric power 1.5c per kwhr			
11)	Refrigeration power costs (Items 9 and 10)		48.20	
12)	Water at 11 cents per 1000 gal (neglected with cooling tower)			
13)	Heat requirement 4.5 × 1000 × 11.7‡ × 2200/e* = 165,000MBtu			
14)	Gas cost, $1.00 million Btu			
15)	Heating cost (Items 13 and 14)		165.00	
16)	Recovery fan power, 0.000157‡ × 1000 head = 0.063 hp			
17)	Recovery fan power, {0.746(16)(2200 + 8101)}/e = 188 kwhr			
18)	Recovery fan power costs (Items 10 and 17)			2.82
19)	Labor to change recovery cells			2.00
20)	Freight to ship used and recharged units			10.00
21)	Regenerate, recover cells			35.00
			213.20	49.82
	Summary			
	Annual fixed charges		110.10	24.85
	Annual maintenance costs		11.69	
	Annual service costs		213.20	49.82
	Total annual owning and operating costs		$334.00	$ 74.67
	Annual savings with air recovery			260.32
			$334.99	$334.99

*Efficiencies are taken in items 9 and 13 as 70 and 75 percent, respectively. ‡Difference in enthalpy, Btu per lb of dry air, between inside and outside, for average winter conditions.

Equipment costs are current approximations. Owning and operating costs are based on Chapter 54 of the 1959 Guide. The efficiencies, *e*, used in formulas of items 9 and 13 were taken respectively as 70 and 75 percent. Summer cooling and winter heating has been considered.

The results of the economic study for these conditions indicate conclusively that it is more economical to recover a portion of the air than to provide all outside air. This applies to both investment and operating costs.

For a prospective installation, the engineer should make a comparable study as outlined herein, using local costs of equipment and services and applicable climatic conditions and air quantities. Where the outside air is contaminated, provision should be made for it to pass through the charcoal adsorber.

For installations of a special nature, where air conditions cannot be economically improved by outside air ventilation or air recovery using activated charcoal, masking or counteraction may prove desirable. Manufacturer's representatives should be consulted for those applications, and the chemistry of the atmosphere determined.

For applications at temperatures above 125 F, specialists on catylatic combustion should be consulted. Above 500 F, problems existing due to obnoxious flue gases can usually be solved by combustion, since most odorous gases are combustible. An economic study similar to that shown in the tables should be made for any system. ≠

NDHA Observes 50th Year; Recounts Industry's Status

. . . at golden anniversary meeting

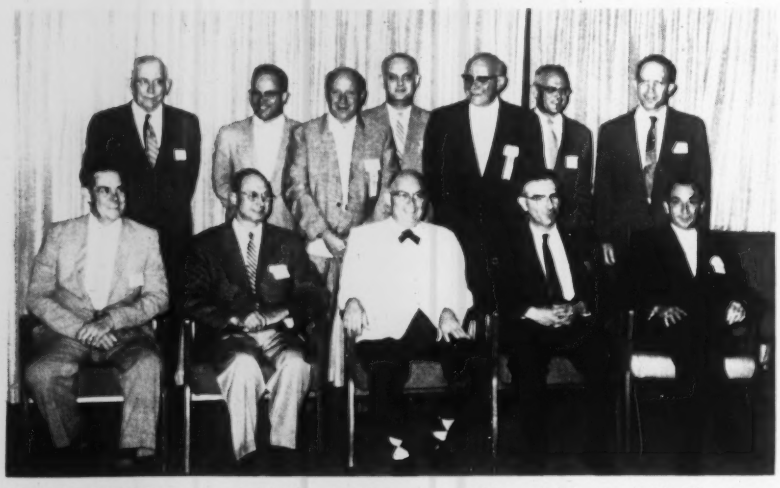
- *steam rate increases greater*
- *average gross revenue up 2.1 percent*
- *almost $4 million in new revenue*
- *rates increased by steps*

BY JOHN F. COLLINS, JR.
Secretary-Treasurer
National District Heating Association

THE National District Heating Association passed a major milestone in its history recently with the observance of its 50th year. NDHA's four-day golden anniversary meeting, held at the Skytop Club in the Pocono Mts. of eastern Pennsylvania, was highlighted by reports on the status of the industry at the half-century mark and the presentation of 26 papers on various technical phases of district steam service.

William G. Gillim, in the annual presidential address, outlined the progress made by the association over the year and stressed the importance of preparedness to meet the challenges of tomorrow.

John F. Collins, Jr., association secretary-treasurer, in his detailed report of the operation of the organization, said that NDHA was in better financial condition than at any previous time in its half century of existence.



BOARD MEMBERS for 1959-60 are: (front row, left to right) James C. Thompson, Atlanta, third vice president; Albert F. Metzger, Pittsburgh, first vice president; George F. Prestwich, Philadelphia, president; William G. Gillim, New York, past president; John D. Lemon, Indianapolis, second vice president; (back row, left to right) John F. Collins, Jr., Pittsburgh, secretary-treasurer; Donald H. Brandt, Jackson, Mich., director; Fred W. Deutsch, Providence, director; Robert H. Swoyer, Allentown, director; Frank C. Meyer, Boston, director; Ernest T. Smith, St. Clair Shores, Mich., director; Carl W. Signor, Detroit, director

Membership Chairman Fred W. Deutsch, manager of sales service, Builders-Providence, Inc., Providence, R. I., reported that through the great activity of members of his committee the association membership totaled 527 at the end of 1958.

New Customers Connected

Trends in the industry in 1958, based on reports from 57 steam utilities, were reported by Foster L. Stephens, chairman of the association's statistics committee and a steam heating engineer for Allegheny County Steam Heating Co., Pittsburgh.

Mr. Stephens said there was a 5 percent increase in total steam sold during the past winter over 1957. This he attributed to increases in degree-days of 3 percent and in connected load of 2 percent. He explained that an increase of 1.2 percent in steam loss and a 1 percent increase in piping radiation surface was a result of colder weather during the past heating season.

Average gross revenue increased 2.1 percent per M lb of steam sold, he said, mostly due to rate increases but to some extent because of upward fuel cost adjustments. (The fuel clauses contained in the rates of nearly all steam suppliers enable them to adjust the price of steam with the rise and fall of their fuel costs without revising their basic rates.)

Invested capital rose 4 percent over

FOURTEEN of NDHA's 32 living past presidents attended past presidents' dinner at golden anniversary meeting. Front row, left to right: John C. Haroldson, Duluth, 1958; John F. Malone, Baltimore, 1947; Leo F. Collins, Detroit, 1955; David W. Loucks, Pittsburgh, 1950; Charles W. Deeg, Philadelphia, 1954; Alfred T. Veness, Rochester, N.Y., 1952; Roy M. McQuitty, St. Louis, 1946. Back row, left to right: Melvin D. Engle, Boston (now Allentown), 1937; George H. Tuttle, Detroit, 1951; Walter M. Gillespie, Dayton, 1957; Sterling S. Sanford, Detroit, 1945; Ernest E. Dubry, Detroit, 1933; Landis Shaw Smith, Rochester, N.Y., 1931; J. C. Hobbs, Pittsburgh, 1920

the year, with boiler capacity boosted 2 percent. Decreases were reported in number of customers served (1.3 percent) and in billing meters (1.0 percent).

Increased Steam Consumption

Increased sales were reported by William C. Kaber, industrial engineer, Union Electric Co., St. Louis. Mr. Kaber said that the 355 new customers connected in 1958 would consume an estimated 2,917,539 M lb of steam, bringing in an annual increased revenue of $3,991,655, an average revenue of $1.37 per M lb, 12 cents higher than in 1957.

The 10 cities with the greatest increases in new business in 1958 in order were: New York, Philadelphia, Detroit, St. Louis, Boston, Indianapolis, Pittsburgh, Rochester, Kansas City, and Baltimore.

Of the new customers, 24 percent had used district steam before, 42 percent are in old buildings using service for the first time, and 34 percent are in new buildings. Ten percent of the estimated additional revenue is derived from loads added by 113 existing customers. On the other hand, 50 customers discontinued the use of purchased steam, resulting in a revenue loss of $223,531 for the year.

In 21 cities there was an increase in the amount of new business over 1957, while in 19 cities there was a decrease. The number of customers lost was the lowest since 1955, but the loss in revenue was greater than in 1957. The losses occurred in 18 cities.

In four cities, boiler capacity is not adequate to add customers. In one of these, capacity may be increased this year. Five other cities have somewhat limited capacities. In two cities in 1958, capacity was increased more than 1100 M lb per hr. Four utilities have increases under consideration.

In 10 cities sales are somewhat limited by distribution facilities. Additions are contemplated in a dozen cities.

Rates Increased by Steps

Rate trends were reported by Clifford O. Thurlow, rate engineer of Commonwealth Services, Inc., Jackson, Mich. Mr. Thurlow said that rates were increased in 15 cities in 1958, compared with eight increases and one decrease in 1957. Further, those this year have been greater percentagewise in most cases—usually in excess of 10 percent—in two instances, over 50 percent, and in six cases, over 25 percent. The tendency is to make increases in charges effective in steps over a period of time.

The committee is considering a proposal that a committee on accounting be created.

Name New Officers, Directors

At the final session, George F. Prestwich, superintendent, coal bureau and steam heating division of Philadelphia Electric Co., was inducted as the 50th president of NDHA. Albert F. Metzger, supervisor of steam utilization, Allegheny County Steam Heating Co., was made first vice president. John D. Lemon, assistant treasurer, Indianapolis Power & Light Co., became second vice president. James C. Thompson, assistant to the vice president, Atlanta branch, Georgia Power Co., was elected third vice president.

Three new directors are named annually by the association for two-year terms. This year Donald H. Brandt, general steam heating supervisor, Consumers Power Co., Jackson, Mich.; Ernest T. Smith, head, Gilsulate Service Div., American Gilsonite Co., St. Clair Shores, Mich.; and Robert H. Swoyer, mechanical research engineer, Pennsylvania Power & Light Co., Allentown, were added to the executive board.

Five other directors remain on the board: Past President Gillim, assistant superintendent, customer service, steam service operations of Consolidated Edison Co., Inc., New York City; NDHA Secretary-Treasurer John F. Collins, Jr.; Fred W. Deutsch, manager, sales service, Builders-Providence, Inc.; Frank C. Meyer, head, steam sales and service division, Boston Edison Co.; and Carl W. Signor, personnel coordinator, central heating department, The Detroit Edison Co.

The next annual meeting of the association will be held at Grove Park Inn, Asheville, N.C., June 6 to 9, 1960.

Reports of the technical papers presented at this year's meeting will appear in future issues. ±

Design Jet Bomber Environment for

● The design of crew environment for modern combat jet aircraft presents problems uncommon to most other heating and air conditioning systems. To permit survival at extreme altitudes and temperatures (ranging from 100 F to −125 F), environment facilities must be integrated as a basic component of the aircraft as an advanced complex weapon system. As such, they must be lightweight, compact, extremely reliable, and easy to maintain. The Boeing B-52G missile platform bomber, a major cog in our Strategic Air Command, has such a system which uses bleed air from the plane's engine compressors for heating and cooling. Air cycle cooling, little used in commercial air conditioning today, was selected as being the most efficient way to make use of this bleed air. Cabin heating is controlled by a unique electronic temperature regulating system which varies the opening of a valve in a bypass line in parallel with the cooling unit. Due to the extremes in altitude —often reached in a matter of seconds—cabin pressurization is a primary consideration. This is effected by a system which limits the quantity of air entering the cabin and controlling the amount released. A differential control keeps a constant pressure differential between the cabin and atmosphere.

Mr. Hartley was graduated from Kansas State University in 1948 with a BS in mechanical engineering. On his graduation he joined Boeing in Seattle and transferred to the company's Wichita division four years later. As a design specialist, he was instrumental in the design of the systems described in this article.

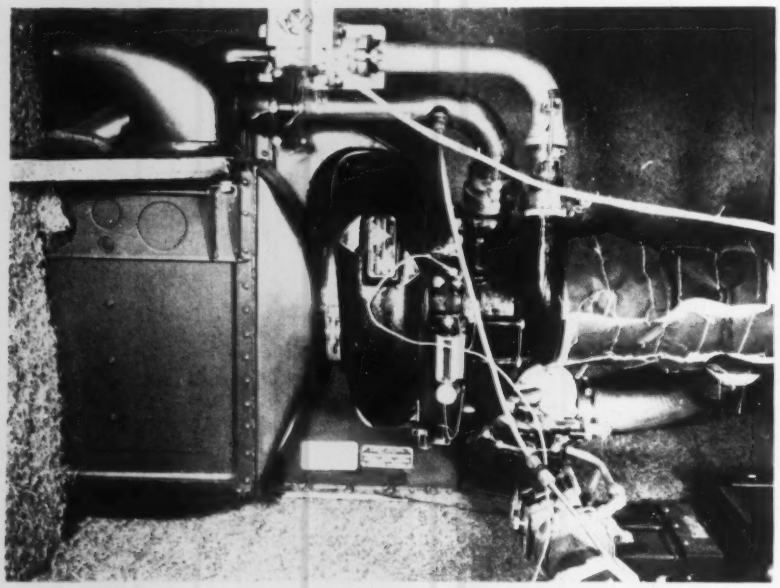
BY AMOS B. HARTLEY
Design Specialist
Boeing Airplane Co.

THE BOEING B-52G is an eight-jet missile platform bomber now in production for the U. S. Air Force's Strategic Air Command at Boeing Airplane Co.'s Wichita, Kan., division. Its six crew members must be furnished with an environment that will allow them to survive the extremes of altitudes and temperatures without detracting from their efficiency throughout the long and complicated task of performing practice combat missions.

The temperature of the air through which the aircraft flies can vary from the extremes of 100 F down to −125 F. The speed of the vehicle through the atmosphere can cause its skin temperature to increase by 50 F. A solar heating load may or may not be present, depending on the time of day, and can vary with the plane's attitude and altitude. Even the amount of electronic equipment operating within the cabin and the number of crew members present are contributing and varying factors which have to be considered.

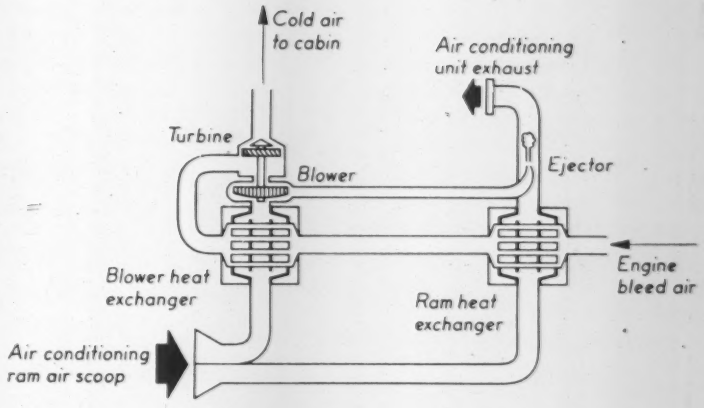
The Boeing B-52G is an advanced complex weapon system, comprising a number of accessory and utility systems of which crew environment control is only one. It must therefore be considered in its proper place in the overall function of the weapon system when determining its design.

During the design of this aircraft it was determined that a source of high energy air taken from the engine compressors and distributed throughout the ship for all accessory and utility systems would result in a substantial weight saving of the overall weapon system. The resulting integrated system represents some compromises. The systems utilizing engine bleed air as a prime energy source on the B-52G are: alternator drives, hydraulic pack drives, water



1 AIR CYCLE MACHINE used for cooling forward crew compartment of B-52G missile platform bomber shown here. Heating is supplied via bypass line and valve in parallel with unit, top. Use of bleed air from aircraft's engine compressors to supply both services results in substantial equipment weight saving

Wide Temperature, Pressure Extremes



2 AIR IS BLED from compressor section and is ducted to refrigeration unit, being filtered to remove oil vapor in the process. Air entering unit is limited to 105 psig. Air cooling takes place by means of two ram air heat exchangers and an expansion turbine. Kinetic energy extracted by the turbine is used to induce ram air flow through secondary heat exchanger

pumps, engine starters, anti-icing of the air foil surfaces and air inlets, pressurizing of fuel tanks, hydraulic reservoirs, and conditioning of the crew cabin.

Utilize Air Cycle Cooling

Along with the decision to use engine bleed air for operation of the air conditioning equipment, it was determined that the most overall airplane utility, both in the air and on the ground, could be achieved by the use of air cycle cooling.

Air cycle cooling, seldom used commercially today, has certain advantages for use in jet aircraft. The machinery required for compression of the cooling medium is already installed in the form of the turbojet engine compressors. The expansion and evaporator sections of a comparable vapor cycle unit are replaced with a small, high speed expansion turbine of 2 percent of the volume.

The cooling medium, being air, can be neglected in the weight of the system and small leaks are of little consequence to operation and reliability.

Fig. 1 shows the air cycle machine used for cooling the forward crew compartment. It weighs 130 lb, occupies 8 cu ft of space, and delivers 90 lb of −5 F air per min. Because this machine requires 23 hp to produce 8 tons of refrigeration, it would not be considered economical in a commercial application.

In powering the air cycle machine from the jet engines, air is bled from the compressor section before the combustion process takes place and is ducted through the aircraft structure to the refrigeration unit. During its trip from engine to cooling unit, the air is filtered to remove oil vapor, and the pressure of the air entering the unit is limited to 105 psig. On some planes the temperature of the bleed air is limited to 450 F.

The schematic diagram shown in Fig. 2 explains the operating components of the machine. Air cooling takes place by means of two ram air heat exchangers and an expansion turbine. Kinetic energy extracted by the turbines is used to induce ram air flow through the secondary heat exchanger.

Outside air from the heat exchanger inlet at the rear of the unit is divided and passes through the primary and secondary heat exchangers. Air from the secondary heat exchanger is increased in energy by the fan attached to the turbine shaft and is exhausted through an ejector in the exit duct of the primary heat exchanger.

Drop Temperature 440 F

Consider an operating condition for the B-52G air cycle unit at sea level on a day requiring cooling. Bleed air enters the heat exchangers at 430 F and 103 psia. At the last heat exchanger exit, the bleed air has a temperature of 145 F and a pressure of 102 psia. The turbine is running at approximately 40,000 rpm, with an exit temperature of −10 F, or a total drop of 440 F in the engine bleed air.

The turbine and fan operating on a single shaft at high speed are the heart of the air cycle machine. This assembly is built and balanced to close tolerances. Ball bearings with special heat transmitting ball retaining rings are used in conjunction with an air lift pump lubricating system.

Fig. 3 shows the air cycle in three diagrams: pressure *vs* volume, temperature *vs* entropy, and pressure *vs* enthalpy. In all cases, compression of

air by the engine takes place between points *A* and *B*, cooling of the bleed air through the ram air heat exchangers takes place along line *BC*, and expansion of the bleed air through the high speed turbine along line *CD*. From point *D* back to point *A* represents the evaporator; however, in aircraft usage of this cycle, turbine discharge air is released into the cabin for cooling and pressurizing and is then released overboard. If one could visualize the cooling medium returning to the engine compressor inlet after release from the cabin, the theoretical cycle would be completed. It must be remembered that the discharge from the cabin is at a lower temperature and higher pressure than point *A*, thus producing a discontinuity between points *D* and *A*.

Calculate Air Cycle Performance

Performance of the air cycle machine can be approximated within 5 percent by rather simple and rapid calculations. Exact performance calculations, however, are more complicated and rely upon certain test data. Horsepower available from the turbine must be balanced against the horsepower required by the ram air fan, as represented in Fig. 3, line *CD*. This line is considered as an adiabatic expansion and can be calculated if the bleed air pressure, temperature, and flow rate are known.

Turbine efficiency is approximately 70 percent at sea level and a heat exchanger effectiveness of 0.9 is a representative value for modern air-to-air heat exchangers.

It must be remembered that humidity can alter the air cycle performance considerably under certain conditions. When the temperature of the medium being expanded through the turbine drops below the dew-point, water, fog, or ice is formed. It is not uncommon for the heat released by the condensation process to raise the turbine discharge temperature by as much as 40 F at sea level.

If the condensed moisture were re-evaporated within the aircraft cabin, no loss in cooling capacity would result. In the B-52G system this is not the case. A water separator is installed between the air cycle machine and the crew cabin to remove entrained moisture and reduce the humidity in the cabin. This unit is capable of removing approximately 60 percent of the entrained moisture by means of a coalescing screen and a centrifugal slinger. The liquid water is drained off and released overboard by means of a float valve.

Control Heating Automatically

Cabin heating and cabin temperature control are provided by a bypass line and valve in parallel with the cooling unit. The temperature of the air entering the cabin is controlled by varying the opening of the valve. This is accomplished automatically by means of an electronic temperature regulator which senses the mixed air temperature in the cabin supply duct, the cabin temperature, and the desired cabin temperature called for by the pilot.

Operation of the regulator is based on the balance principal of an electrical bridge circuit, two arms of the bridge being contained in the regulator circuit. The cabin air temperature pickup provides a third arm in the bridge, while the temperature selector at the pilot's station serves as the fourth element for electrical balance. The bridge remains in balance so long as the temperature pickup resistance equals the temperature selector resistance.

Any temperature change in the cabin alters resistance of the pickup and disturbs the electrical balance of the bridge circuit. This unbalance sets up a corrective procedure, that of bypassing hot air in greater or lesser quantity by repositioning the bypass valve until the system attains balance or, in other words, until the temperature desired is attained. Repositioning the temperature selector rheostat likewise causes a bridge unbalance, and the regulator again sets up corrective action.

The duct anticipator does not form a part of the bridge circuit itself. The anticipator voltage output is mixed with bridge circuit output at a rate determined by the regulator in order to effect a system balance. When a temperature change occurs in the duct air stream, the anticipator signals the regulator. This signal is interpreted in terms of rate of change. Although the bridge circuit may be at balance, it will cause the bypass valve setting to change in agreement with the variation in temperature before that transient change can affect the cabin temperature.

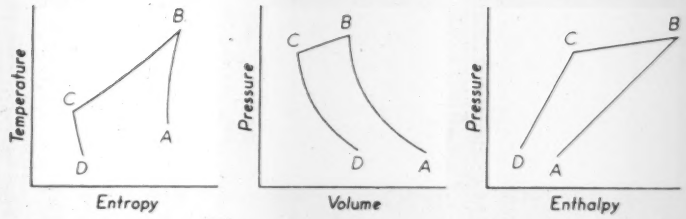
Maintain Cabin Pressurization

Cabin pressurization is provided by the simple expediency of limiting the quantity of air entering the cabin and controlling the amount of air which is released. The pressure schedule shown in Fig. 4 is normally maintained automatically. An over-pressure relief valve and over-ride controls for nonpressurized flight are a part of the system.

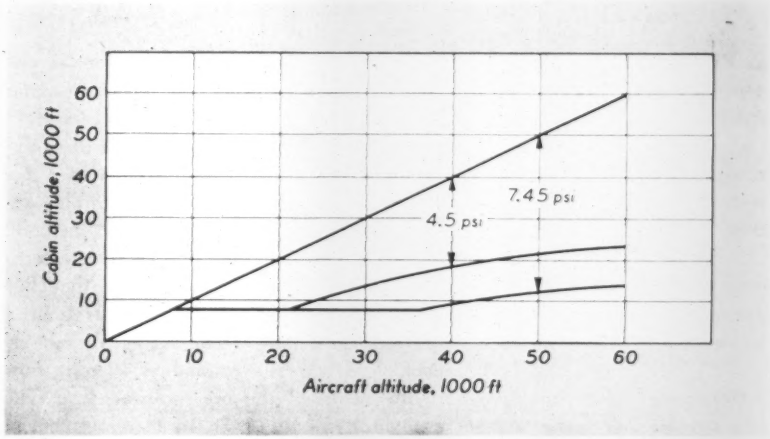
The air entering the cabin is limited by means of a flow control valve which also acts as a pressure limiter to the cooling unit. It consists of a venturi, a pneumatic servo, and a butterfly valve. The butterfly is located at the downstream side of the venturi and is controlled by the pneumatic servo. The servo mechanism is calibrated to measure a specific static differential between the upstream pressure and the venturi throat pressure. Variation of this pressure differential from the calibrated value causes the servo to move or reposition the butterfly.

As upstream pressure increases, air velocity through the venturi increases, causing an increase in weight flow to the cabin. With the increase in air velocity in the throat, the static pressure decreases and the differential pressure is changed. This change causes the servo to move the butterfly toward the closed position, thereby restricting the valve outlet and reducing the air flow into the cabin to the calibrated value. With a decrease in upstream pressure, the opposite function occurs to maintain a constant weight flow of air to the cabin.

The amount of air being released from the cabin is controlled by an



3 THREE ASPECTS of air cycle—pressure *vs* volume, temperature *vs* entropy, pressure *vs* enthalpy—are plotted above. Compression of air by engines takes place between points *A* and *B*, cooling of bleed air through ram air heat exchangers along line *BC*, expansion of bleed air through high speed turbine along line *CD*



4 CABIN PRESSURIZATION schedule at various altitudes illustrated above is normally maintained automatically. Overpressure relief valve and over-ride controls for nonpressurized flight are part of system

outflow valve which, in turn, is positioned by a pressure regulator. The valve is pneumatically operated, positioned by air pressure signals from the cabin pressure regulator. A change in the pressure signal against the valve diaphragm causes it to move and, in turn, moves the attached cup-shaped valve poppet. This movement decreases or increases the air escape passage from the cabin.

This arrangement provides a balanced valve which is affected directly and immediately by a slight pressure change on the diaphragm. A closing spring is provided in order to hold the valve in the closed position when a pressure differential does not exist across the diaphragm.

The cabin pressure regulator contains an isobaric and two differential control systems which control the cabin pressure in accordance with the regimes of Fig. 4. At altitudes below 8000 ft the regulator allows the cabin to be unpressurized. Control chamber pressure is sufficient to compress the evacuated isobaric bellows, holding the isobaric needle valve in the open position. Cabin air is metered into the control chamber through the filter, flows out through the open needle valve, and is vented to the atmosphere.

Since the filter orifice is smaller than the needle valve, pressure in the control chamber becomes less than cabin pressure. This control pressure is connected to the outflow valve chamber which causes the outflow valve diaphragm to move toward the low pressure side, compressing the closing spring, and opening the valve. As the aircraft approaches an altitude of 8000 ft, the isobaric control action begins.

In the isobaric range (8000 to 35,750 ft), the cabin altitude is kept constant at 8000 ft. In this range, as the pressure in the control chamber tends to decrease with increasing altitude, the bellows expands and moves the needle valve toward its seat, thereby increasing the restriction to the atmosphere vent. This action results in a constant control head pressure throughout the isobaric range.

As the control pressure on the outflow valve diaphragm is held constant, the valve opening is governed by only the cabin pressure. As the airplane ascends, the cabin pressure tends to decrease. As this occurs, the valve diaphragm moves toward the low pressure side, thus closing the valve enough to allow the cabin pressure to balance the diaphragm.

Constant Pressure Differential

The differential control maintains a constant pressure differential between the cabin and atmosphere. The 7.45 psi differential control is in operation above 35,750 ft, while the 4.5 psi differential control operation is made ineffective by closing its needle valve vent line by means of a solenoid valve. This allows the higher pressure differential control (7.45) to operate by letting the control chamber pressure build up.

As the aircraft ascends above an altitude which would cause a differential pressure between the cabin and atmosphere greater than 7.45 psi, the pressure differential between the control chamber and atmosphere forces the differential diaphragm to overcome the opposing force of the spring and to move the differential needle valve off its seat until the differential of 7.45 psi is re-established across the differential diaphragm.

Cabin air is distributed via small aluminum ducts to the various crew stations. Flow control butterfly valves are used at the discretion of the crew. The outlets are provided with movable deflector vanes for air flow direction control.

No return air system is provided. Air from the outlets at each crew station flows to the outflow valve where it is released. ±

Calculating Pipe Stress Efficiently

. . . a comparison of two different procedures showing close agreement

● In the past year or so, Heating, Piping & Air Conditioning has published two comprehensive procedures for calculating piping stresses. The two authors, K. Hao Hsiao and Edwin A. Wert, both top authorities in this area of engineering, have approached the problem differently. Do their results jibe? Mr. Hsiao says they do, and in this article presents calculations which show the results obtained from the two procedures to be in very close agreement.

The author has both BA and MA degrees from Stanford University. Following graduation he was employed in the mechanical engineering department of Ohio State University. He later worked with Aluminium, Ltd. in Montreal and with Canadair, Ltd. as a stress engineer in the same city. Before joining Holmes & Narver, Inc., he was also employed by Stadler, Hurter & Co., consulting engineers.

BY K. HAO HSIAO
Holmes & Narver, Inc.
Engineers-Constructors

IN THE ARTICLE, *Calculating Pipe Stress Efficiently*, published in three parts in the September and December 1957 and January 1958 issues of Heating, Piping & Air Conditioning, the author developed a tabular procedure for the efficient and time-saving calculation of forces, moments, and stresses due to thermal expansion of piping systems.

This procedure is based on the 1955 American Standard Code for Pressure Piping, which contains important changes in: (1) the application of the flexibility factor, K, and the stress intensification factor, i; (2) the formulas and calculation of factors K and i, characteristic factor, h, allowable stress (stress range), maximum expansion stress, force and moment ranges, and hot and cold reactions; and (3) the phenomenon of self springing. Introduction of the transverse and differential virtual lengths are the major reasons for the time-saving feature of this procedure.

In the September and October 1958 issues of this publication, there appeared a two-part article, *Advanced Approach Simplifies Piping Flexibility Analysis*. The author, Edwin A. Wert, presented an "algebraic method" for hand calculation and a well-organized input data form for computation by the Kellogg method with the IBM 650 electronic digital computer. As an illustration, a two-anchor, three-dimensional system was analyzed, using both methods. Mr. Wert's example system is now analyzed here by means of the present procedure. The numerical results are found to be in close agreement with his. Thus, the two methods check each other for validity and accuracy.

Checking Against Mr. Wert's Procedure

Assume end h of the piping system in Table 1 as fixed and end a as tending to expand. Then, the forces X, Y, and Z, which restrain end a and prevent it from expansion, are transferred to the centroid of the system, forming the centroidal axes of the system. In actual computation, however, the original axes are used instead of the centrodial axes. (The location of the origin of the original axes are so selected as to reduce the calculations to a minimum.) In this case, they are the X, Y, and Z axes shown in Table 1.

The numerical values for branches in torsion in each perpendicular plane are increased 30 percent to take into account their torsional effect on flexibility, tabulated in rows (2), (4), and (6). Since each elbow contributes greater flexibility in bending than that of its true length to the system, this increased flexibility is accounted for by using a "virtual length," KL_a, in calculating line inertias in the plane of elbow, and a "transverse virtual length," $\alpha = (K + 1) L_a/2$, in planes perpendicular to the elbow. This is equivalent to applying the transverse virtual length to all elbows in a system and a "differential virtual length," $\beta = (K - 1) L_a/2$ to only elbows in their own planes. The sum of increases in

TABLE 1—CALCULATIONS OF LINE INERTIAS and solutions for force ranges X, Y, and Z, relative moment ranges M'_{xy}, M'_{xz}, M'_{yz} are given below

	Duct Section	X	Y	Z	L^2	L	L_x	L_x^2	L_y	L_y^2	L_z	L_z^2	L_{xy}	L_{xz}	L_{yz}
BRANCH // Z	ab	0	0	-8	2744	14	0	0	0	0	-112	896	0	0	0
	(1) SUM			I_1											
	(2) (1)×0.3					4.2	0	0	0	0			0		
BRANCH // Y	cd	0	7.17	0	1875	12.33	0	0	88.41	633.9	0	0	0	0	0
	gh	22	23.78	0	4835	16.91	372.02	8184	402.12	9562.4	0	0	8847	0	0
	(3) SUM			I_2	6710	29.24	372.02	8184	490.53	10196	0	0	8847	0	0
	(4) (3)×0.3					8.77	111.61	2455			0	0		0	
BRANCH // X	ef	11	14.33	0	8000	20	220	2420	286.6	4107	0	0	3153	0	0
	(5) SUM			I_3											
	(6) (5)×0.3					6			85.98	1232	0	0			0
ELBOWS // XY	de					L = 1	.36	.13	13.97	195.2	0	0	5.03	0	0
	fg						21.64	468.29	14.69	215.8	0	0	317.89	0	0
	(7) SUM					no. ells	22.00	468.42	28.66	411.0	0	0	322.92	0	0
	(8) (7)×β					9.98	109.78	2337	143.0	2051			1611		
ELBOWS // XZ						L = 1									
	(9) SUM					no. ells									
	(10) (9)×β														
ELBOWS // YZ	bc					L = 1	0	0	.36	.13	-.36	.13	0	0	-.13
	(11) SUM					no. ells									
	(12) (11)×β					4.99			1.80	.65	-1.80	.65			-.65
	(13) (7)+(9)+(11)					3	22	468.42	29.02	411.13	-.36	.13	322.92	0	-.13
	(14) (13)×α					19.68	144.32	3072.84	190.37	2697	-2.36	.85	2118	0	-.85
	(15) (1)+(3)+(5)+(14)					82.92	736.34	13676	967.50	17000	-114.36	896.85	14118	0	-.85

LINE DATA

8", Sch. 40
A-53, Gr. B

D	8.625	Δ_Y	0.0814'
t	0.322	Δ_Z	-0.0460'
I	72.5	h	0.224
S	16.81	K	7.36
T	422°F	L_a	1.57
e	50.8'/100'	i	2.44
E_w	27.4 (10^6)	d	6.56'
E_c	29 (10^6)	e	4.99'
Δ_x	0.0475'	S_h	17052

XY

(16)	Σ·(2)+(4)+(6)+(14)	97.10	846.12	16013	1110.50	19051			15729		
(17)	(16)÷Σ L		$\bar{x}$ = 8.72		$\bar{y}$ = 11.43						
(18)	(17)×Σ		$\bar{x}\Sigma L_x$ = 7375		$\bar{y}\Sigma L_y$ = 12700			$\bar{y}\Sigma L_x$ = 2660			
(19)	(16)-(18)		I'_y = 8638		I'_x = 6351			I_{xy} = 6069			

XZ

(20)	Σ·(2)+(4)+(6)+(14)	91.69	847.95	16131			-114.36	896.85		0	
(21)	(20)÷Σ L		$\bar{x}$ = 9.24			Σ = -1.247					
(22)	(21)×Σ		$\bar{x}\Sigma L_x$ = 7840				$\bar{x}\Sigma L_x$ = 142.80		$\bar{x}\Sigma L_z$ = -1058		
(23)	(20)-(22)		I'_z = 8291				I'_z = 754.05		I_{xz} = 1058		

YZ

(24)	Σ·(2)+(4)+(6)+(14)	93.91			1055.28	18232.65	-116.16	897.5			-1.50
(25)	(24)÷Σ L				$\bar{y}$ = 11.24		$\bar{z}$ = -1.237				
(26)	(25)×Σ				$\bar{y}\Sigma L_y$ = 11850		$\bar{z}\Sigma L_z$ = 143.7			$\bar{z}\Sigma L_y$ = -1304	
(27)	(24)-(26)		$E_s I/144 = 13.8(10^6)$		I'_x = 6383		I'_y = 754			I_{yz} = 1302	

COEFFICIENTS

$$\frac{I_{xy}}{I_x} = \frac{6069}{7893} = .769 \quad \text{Ⓐ}$$

$$\frac{I_{xz}}{I_x} = -\frac{1058}{7893} = -.134 \quad \text{Ⓑ}$$

$$\frac{\Delta_x E_s I}{I_x 144} = \frac{.0475(13.8)10^6}{7893} = 83.2 \quad \text{Ⓒ}$$

(a)

$$\frac{I_{xy}}{I_y} = \frac{10288}{6069} = 1.696 \qquad \frac{I_{xz}}{I_{xy}} = -\frac{1302}{6069} = -.214 \qquad \frac{\Delta_x E_s I}{I_{xy} 144} = \frac{.0814(13.8)10^6}{6069} = 185$$

(b)

$$\frac{I_{xz}}{I_{xz}} = \frac{1302}{1058} = 1.230 \qquad \frac{I_z}{I_{xz}} = \frac{15900}{1058} = 15.030 \qquad \frac{\Delta_x E_s I}{I_{xz} 144} = \frac{-.04596(13.8)10^6}{1058} = -600$$

(c)

I'_x =	6351	I'_y =	8638	I'_z = 8291
I''_x =	754	I''_y =	754	I''_z = 6383
$I_{y/2}$ =	224	$I_{y/2}$ =	224	$I_{z/2}$ = 554
$I_{x/2}$ =	554	$I_{z/2}$ =	667	$I_{x/2}$ = 667
I_x =	7893	I_y =	10288	I_z = 15900

FORCES FROM COEFFICIENTS

$X' = \frac{X}{Z} = \frac{508}{5} = 61.6$

$Y' = \frac{Y}{Z} = \frac{291}{5} = 58.2$

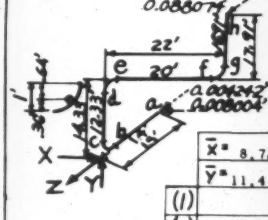
(1)	Ⓐ+(b)	0.927	-0.348 Ⓔ	268.2
(2)	(a)+Ⓒ	-1.999	14.896 Ⓕ	-516.8
(3)	(2)×Ⓓ	0.087 Ⓓ	-0.348	12.1 Ⓖ
(4)	(1)-(3)	0.880 Ⓐ		256.1 Ⓑ

$$Y = \frac{Ⓑ}{Ⓐ} = \frac{256.1}{0.88} = 291$$

$$\frac{Ⓖ}{Ⓔ} = \frac{-0.348}{14.896} = -0.02335$$

$$Z = \frac{Ⓖ - Ⓓ Y}{Ⓓ} = \frac{12.1 - 0.087(291)}{-0.348} = 5$$

$$X = Ⓒ - Ⓐ Y - Ⓓ Z = 83.2 + 0.769(291) + 0.134(5) = 508$$



POINT	a	d	e	h
X	0	0	1	22
Y	0	13.33	14.33	32.24
Z	-15	0	0	0
$\bar{x}$ = 8.72	$X-\bar{x}$	-8.72	-8.72	-7.72	13.28
$\bar{y}$ = 11.43	$Y-\bar{y}$	-11.43	1.90	2.90	20.81
(1)	$X'(y-\bar{y})$	-705	117.1	178.8	1283
(2)	$Y'(x-\bar{x})$	-507.4	-507.4	-449	773
(1)-(2)	M'_{xy}	-197.6	624.5	627.8	510

		a	d	e	h
$\bar{z}$ = -1.247	$z-\bar{z}$	-13.75	1.247	1.247	1.247
(3)	$X'(z-\bar{z})$	-847	76.8	76.8	76.8
(4) $\bar{x}$ = 9.24	$x-\bar{x}$	-9.2	-9.24	-8.24	12.76
(3)-(4)	M'_{xz}	-837.8	86	85	64
$\bar{z}$ = -1.237	$z-\bar{z}$	-13.76	1.237	1.237	1.237
(5)	$Y'(z-\bar{z})$	-800	72	72	72
(6) $\bar{y}$ = 11.24	$y-\bar{y}$	-11.24	2.09	3.09	21
(5)-(6)	M'_{yz}	-788.8	70	69	51

TABLE 2—CALCULATIONS of moment, torque, stress ranges from relative moment ranges of Table 1 are tabulated below. Comparison of results obtained by use of Kellogg method also given

	Forces (hot)			Moments and torques (hot)						Controlling stress range		
				at *a*		at *b*		at *c*				
	X	*Y*	*Z* = *R*	*M*	*T*	*M*	*T*	*M*	*T*	at *a*	at *b*	at *c*
Author's Procedure												
From Table 1	308	291	5 424									
From Table 2				1150(1)	197.6	513(2)	64	634(3)	69			
Multiplied by *Z* = 5				5750	988	2565	320	3170	345	4400(4)	1957(5)	5850(6)
Kellogg method	289	307	6 422	5728(7)	1008	2550(8)	307	3274(9)	99(10)	4395	1940	5801
Ratio	1.07	0.95	1.00	1.00	0.98	1.00	1.04	0.97		1.00	1.01	1.01

The following are computed from the values in Table 2: (1) $\sqrt{837.8^2 + 788.8^2} = 1150$. (2) $\sqrt{510^2 + 51^2} = 513$. (3) $\sqrt{627.8^2 + 85^2} = 634$. (4) $[12 (29)]/[16.81 (27.4)] \sqrt{575^2 + 988^2} = 4400$ psi. (5) $0.756/(256.5^2 + 320^2] = 3957$ psi. (6) $0.756/[[2.44(3170)]^2 + 345^2] = 5850$ psi.

The following are calculated from the results of the Kellogg method, as computed by Mr. Wert: (7) $\sqrt{416^2 + 3937^2} = 5728$ ft-lb. (8) $\sqrt{189^2 + 2543^2} = 2550$ ft-lb. (9) $3464 (27.4/29) = 3274$ ft-lb. (10) $105 (27.4/29) = 99$ ft-lb.

flexibility for elbows in plane *XY* due to β is tabulated in row (8), and those in the other two planes are in rows (10) and (12).

The calculation of line inertias of the system, the substitutions of these values in S. W. Spielvogel's equations, and the solution of these equations for the expansion force ranges *X*, *Y*, and *Z* are efficiently carried out in tabular form.

Then, the coordinates of points *x*, *y*, and *z* and the centroidal coordinates of the system $\bar{x}$, $\bar{y}$ and $\bar{z}$ are first filled in at the bottom of Table 1. The relative moment values on rows (1), (2), (3), (4), (5), and (6) are calculated. The total relative moments in three perpendicular planes, M'_{xy}, M'_{xz}, and M'_{yz} are the differences of these values; i.e., M'_{xy} = (1) − (2), M'_{xz} = (3) − (4), and M'_{yz} = (5) − (6).

Nomenclature

L = length of each piping branch, ft

x, y, z = coordinates of the centroid of each piping branch or elbow with respect to the original arbitrarily chosen *X*, *Y*, and *Z* axes, ft

$\bar{x}, \bar{y}, \bar{z}$ = coordinates of the centroid of piping system with respect to the original arbitrarily chosen *X*, *Y*, and *Z* axes, ft

I_x, I_y, I_z = moments of inertia of the system about its centroidal axes, ft^4 (magnified 12 times)

I_{xy}, I_{xz}, I_{yz} = products of inertia of the system about its centroidal axes, ft^4

I_1 = centroidal moment of inertia of branches parallel to *Z* axis, ft^4 (magnified 12 times)

I_2 = centroidal moment of inertia of branches parallel to *Y* axis, ft^4

I_3 = centroidal moment of inertia of branches parallel to *X* axis, ft^4

I_{ox}, I_{oy}, I_{oz} = sums of centroidal moments of inertia of elbows about their own respective neutral axes, ft^4

m = number of elbows in planes parallel to the axis of I_o

n = number of elbows in planes perpendicular to the axis of I_o

$I_{oxy}, I_{oxz}, I_{oyz}$ = sums of centroidal products of inertia of elbows parallel to the plane of inertia, ft^4

$\Delta x, \Delta y, \Delta z$ = total thermal expansion of the system in the *X*, *Y*, and *Z* directions respectively, in.

E_h = modulus of elasticity of the piping material at operating temperature or in the hot condition, psi

E_c = modulus of elasticity at installation temperature or in the cold condition, psi

I = moment of inertia of the cross-sectional metal area of the pipe, in.^{4}

S = section modulus of pipe, in.^{3}

D = outside diameter of pipe, in.

t = thickness of pipe wall, in.

r = mean radius of pipe, in.

T = temperature, F

e = thermal expansion in 100 ft of pipe due to a rise from installation temperature to operating temperature, in. per 100 ft

R = radius of curvature of elbow or quarter bend, ft

X, Y, Z = forces due to expansion, lb

M_{xy}, M_{xz}, M_{yz} = bending moments due to X, Y, and Z forces in *XY*, *XZ*, and *YZ* planes (one of these moments is actually a torque) ft-lb

X', Y', Z' = relative force values

$M'_{xy}, M'_{xz}, M'_{yz}$ = relative moment values in *XY*, *XZ*, and *YZ* planes

M'_d, M_d = relative and absolute values of combined bending moment at point *d* of the system, ft-lb

T'_d, T_d = relative and absolute values of torque at point *d*, ft-lb

h = characteristic factor

K = flexibility factor

L_a = actual length of elbow or quarter bend, or effective length of mitre bend, ft

i = stress intensification factor

α = transverse virtual length, ft

β = differential virtual length, ft

θ = one half angle between adjacent mitre axes, degrees

c = cold spring factor

X_h, X_c = values of *X* in hot and cold conditions, lb

s_b = maximum bending stress, psi

s_t = corresponding torsional stress, psi

s_a = allowable stress range, psi

f = stress range reduction factor, (f = 1 for 7000 or less temperature cycles over expected life of piping.)

(1) to (27) = numerals each representing one row of figures

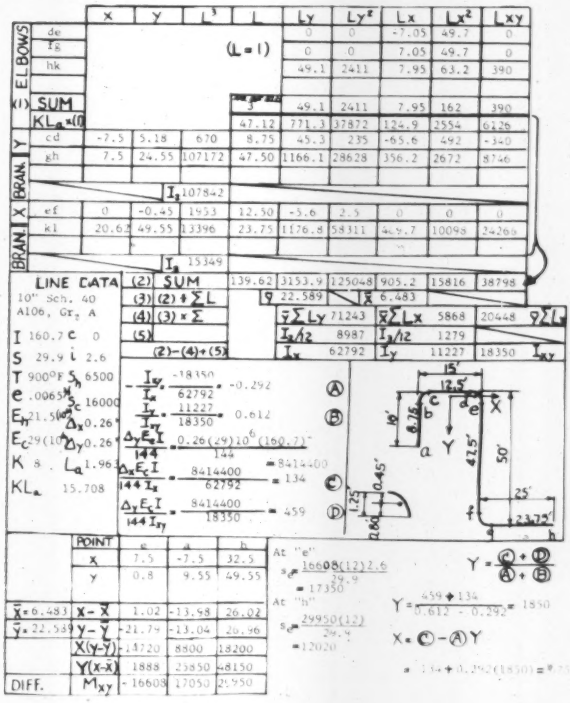
A, *B*, *C* = symbols each representing one numerical value

(a), (b), (c) = symbols each representing three values *A*, *B*, and *C*

N = total number of elbows in a system

N_{xy} = number of elbows parallel to *XY* plane

TABLE 3—COMPLETE SOLUTION for single-plane system from simple sketch to final values of force, moment, stress ranges presented here



Of the three relative moment values given, two are bending and one is torsional. The greatest vector sum of the former, multiplied by the force range Z, gives the maximum combined bending moment range of the system. The latter, multiplied by Z, gives the corresponding torque range. This operation is shown by the calculation in Table 2 of $M_a = 5750$ ft-lb and $T_a = 988$ ft-lb. Owing to the high stress intensification factor at the elbow e, the controlling stress range is at e, and is found to be 5850 psi. For the formulas and definitions of the controlling stress range, allowable stress range, and the hot and cold reactions, the reader is referred to the author's previous articles.

The hot modulous of elasticity E_h is used in the *Coefficients* section of Table 1 in order to obtain final results to compare with the hot reactions $(R\text{-}H)$, computed by Mr. Wert. Also, a conversion factor, 144, is used in the same section instead of 1728, because the "anchor movements" in Mr. Wert's article, i.e., $\triangle_X$ $\triangle_Y$, and $\triangle_Z$, are expressed in feet. These anchor movements are shown as dashed-arrows in the piping configuration in Table 1.

Other factors in the *Line Data* section of Table 1 are obtained as follows:

$$h = 12\ (0.322)/(4.152)^2 = 0.224$$
$$\alpha = [(7.36 + 1)/2] \times 1.57 = 6.56$$
$$\beta = [(7.36 - 1)/2] \times 1.57 = 4.99$$
$$\Delta_x = -0.008004 + 22(0.0303)/12 = 0.0475 \text{ ft}$$
$$\Delta_y = 32.24(0.0303)/12 = 0.0814 \text{ ft}$$
$$\Delta_z = -(0.088074 - 0.004242) + 15(0.0303)/12 = -0.0460 \text{ ft}$$

TABLE 4—FINAL RESULTS from Table 3 are compared with electronically computed results of Kellogg method

	Multipliers	Forces		Moments			Stresses	
		X	Y	M_a	M_e	M_h	at e	at h
Author's procedure								
Range		675	1850	17,050	16,608	29,950	17,350	12,020
Hot	0.742(1)	501	1371	12,660	12,315	22,200		
Cold	0.495(2)	334	916	8450	8225	14,830		
Kellogg method								
Range							17,350	12,030(3)
Hot		500	1370	12,675	12,317	22,225		
Cold		330	910	8450	—	14,825		
Ratios								
Range							1.0	1.0
Hot		1.0	1.0	1.0	1.0	1.0		
Cold		1.01	1.01	1.0	—	1.0		

(1) $E_h/E_c = 21.5/29 = 0.742$. (2) $1 - e_h/e_c(E_c/E_h) = 1 - 0.500/17,350(29/21.5) = 0.495$. (3) $18925(29/21.5) = 12,030$.

The torque at e (345 ft-lb), being much smaller than moments in magnitude, does not affect the accuracies of the resultant moment and controlling stress range. Hence, its ratio is not shown in Table 2. In general, the accuracies of the smallest force and torque do not affect the resulting design of the piping system. Therefore they are of no great importance.

Checking Against the Kellogg Method

In my previous article, only three-dimensional piping systems were used as example problems. Hence, it is appropriate to present here the tabular solution for a single-plane system to illustrate its simplicity and check its accuracy against the rigorous Kellogg method. Such a system is taken from page 124 of the M. W. Kellogg Co.'s *Design of Piping Systems*.

The solution for force, moment, and stress ranges are given in Table 3. Observing the position of the origin of centroidal axes, i.e., $\bar{x} = 6.483$ ft and $\bar{y} = 22.589$ ft, one can conclude that the maximum bending moment and the controlling stress range are at e, where both X and Y forces cause moments in the same counterclockwise direction. The comparison of final results with Kellogg's is given in Table 4, which indicates nearly complete identity between the two sets of results.

The calculations for force ranges X and Y are based on Equations 24 and 25 of the author's previous articles:

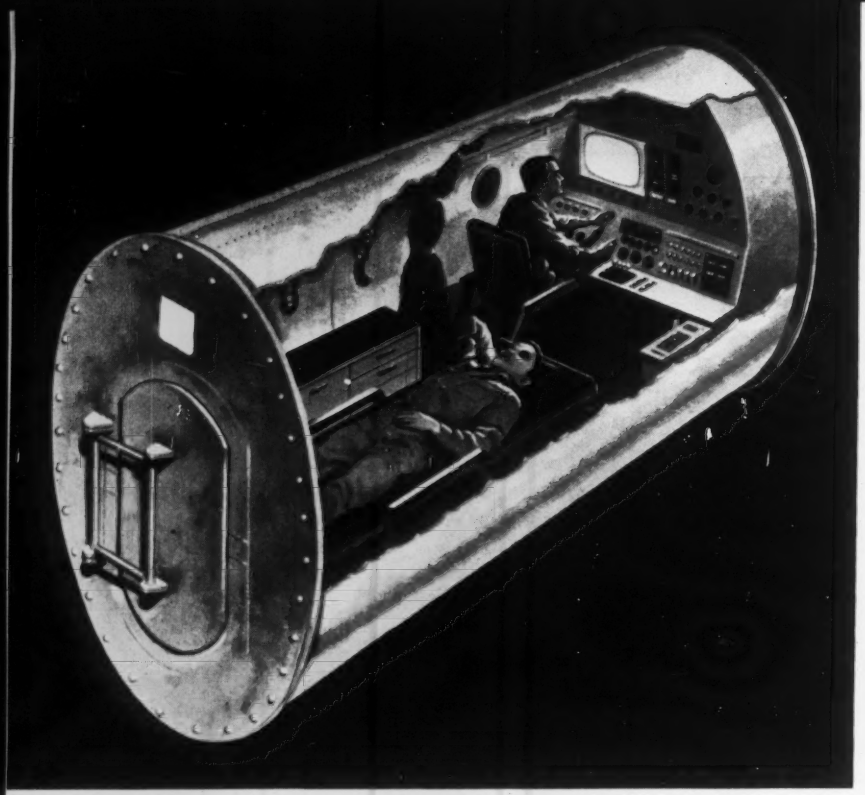
$$X - Y\,(I_{xy}/I_x) = (\Delta_x E_c I)/1728 I_x \quad \text{.....[24]}$$
$$-X + Y\,(I_y/I_{xy}) = (\Delta_y E_c I)/1728 I_{xy} \quad \text{.....[25]}$$

The conversion factor 1728 has been substituted by 144, because the thermal expansions $\triangle_X$ and $\triangle_Y$ are expressed in feet.

For symmetrical single plane systems, Table 3 can be further simplified. For instance, if Y-axis is placed on the centerline of the system, it is only necessary to find $\bar{y}$ for just half of the system, under half of the total expansion $\triangle_X/2$, to simplify the solution. Since, in this case, $I_y = I_{xy} = 0$, Equations 24 and 25 are reduced to only one equation:

$$X = \Delta_x(EI)/2(1728 I_x)$$

where I_X is calculated for only half of the system. Consequently, the x, Lx, Lx^2 and Lxy columns can be eliminated from Table 3.



ARTIST'S CONCEPTION shows laboratory space cabin occupants on their 30 day isolated trip to nowhere

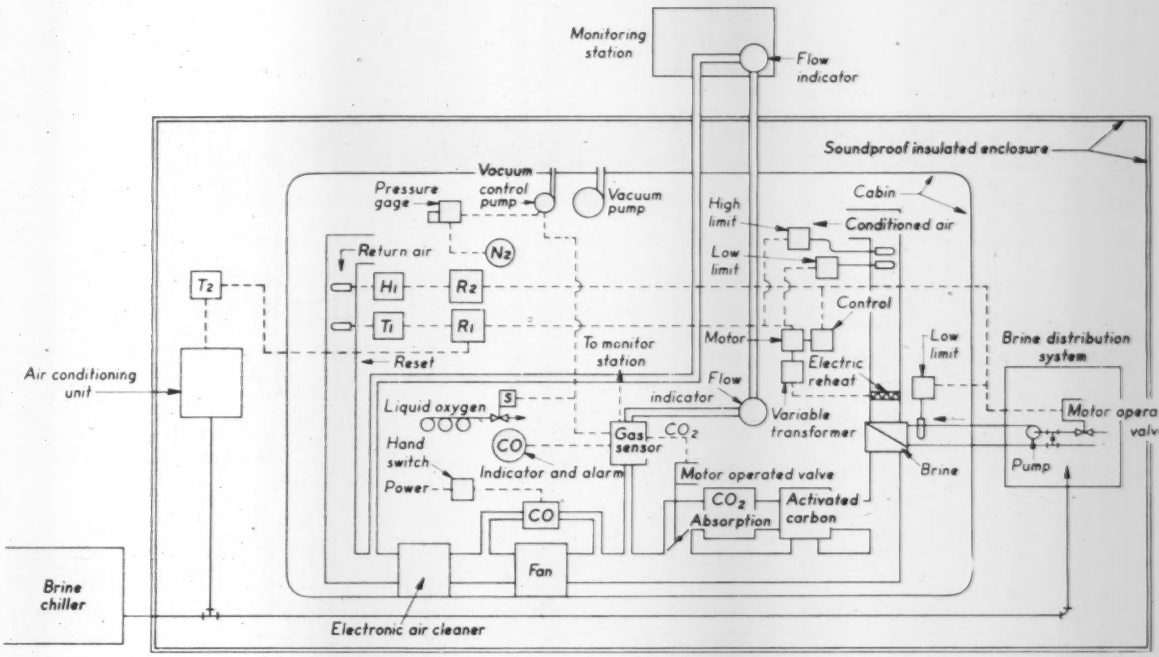
BY L. N. BECKLUND
Staff Advisor, Technical Section
Minneapolis-Honeywell Regulator Co.

New Outer Space Cabin Lab To Supply Valuable Data

. . . for design of environment for survival of tomorrow's space pioneers

● Man's ambition to conquer outer space is giving birth to a new challenge to the heating and air conditioning engineer — the design of environment control that will make the space vehicle livable. A new laboratory test space cabin, recently completed at the Air Force's school of space medicine, will simulate actual space travel to gather information on human psychological and physiological reaction to prolonged exposure to space flight conditions. The temperature-humidity aspects of this operation and the cabin's gaseous composition control were prime considerations in the design of this chamber and the data gained from the impending tests will no doubt furnish significant criteria for the design of environmental control systems for tomorrow's space ship.

L. N. Becklund received both his BA and masters degrees from the University of Minnesota. He joined Minneapolis-Honeywell in 1945. From 1947 to 1958 he served as manager of the technical section of the company's merchandising department. In April of last year, Mr. Becklund was named staff advisor for the technical section.



1 SCHEMATIC LAYOUT shows arrangement of air handling system and control systems. Cabin will simulate space travel conditions to study psychological, physiological effects on occupants

WITHIN a few weeks, two Air Force men at Brooks AFB will take a 30-day lease on what is probably the world's smallest air conditioned "apartment." It may well be the most *completely* air conditioned — even the most completely self-contained. With the exception of electric power and chilled brine piped in, all they will need for the month will be included within their 380 cu ft (pet air space) compartment: food, water, oxygen, and waste treatment facilities.

These men will be starting the first full length "space flight" in a two-place space cabin simulator now being installed in the laboratories of the School of Aviation Medicine's Div. of Space Medicine.

Describing their "flight," Lt. Col. George R. Steinkamp, chief of the division's Dept. of Astroecology, said:

"The men who enter the cabin will be completely sealed off from the world. Time will weigh heavily on their minds and boredom will become their constant companion. The day-night cycle will be lost. Though they will be able to stand erect and move about a bit in the cabin, they will still be greatly cramped. Thirty days can be a very long time."

These conditions will be strictly intentional, for the simulator is to be used in studying psychological as well as physiological reactions to prolonged exposure to the space flight conditions that can be readily simulated in the laboratory for extended periods. These, presumably, do not include weightlessness, at present; but they do include the confinement and isolation of the space traveler, and something of his sense of utter dependence, not only for comfort but for life itself, on the physical resources of his little "island in the sky."

Except for a small air lock for passing out biological samples, their only means of communication with the "ground" will be radio. All that might remind them of the umbilical connections between their steel egg and the laboratory matrix is carefully concealed or disguised. Everything they might expect to find in somewhat the same form aboard an actual space ship, from liquid oxygen bottles to a solid waste incinerator, has been compacted into the steel tank measuring 5 × 12 × 8 ft high.

Broader Scope than Conventional Systems

When the design of this simulator was undertaken for the school, the engineers faced problems considerably broader in scope than merely to miniaturize a conventional air conditioning system. The problems ranged from design of suitable seats to color dynamics. They included "municipal engineering" in designing compact facilities for recovery and purification of water for re-use and for incinerating solid wastes (with maximum efficiency of combustion). They took on the aspect of chemical engineering in the requirement for close control of the composition and pressure of the cabin atmosphere.

Although unique in several respects, the temperature-humidity problem was certainly much less complex than it will be in building an actual space ship for long flights. Since the dependence on radiant means of energy input and rejection that will presumably characterize the engineering of structures for airless space could not be simulated in the laboratory, the designers made a virtue of necessity by supplying, not only electric power, but also the cooling medium, brine, from outside the cabin proper.

In the table below are listed the environmental control specifications for the cabin:

	Control point	Accuracy
Oxygen (partial pressure)	100 to 400 mm*	± 4.5 mm Hg
Carbon dioxide	0 to 80 mm	± 1.3 mm
Carbon monoxide	0.07 mm max. §	
Total pressure	14.7 to 4.7 psia	
Altitude equivalent	0 to 28,500 ft	± 500 ft
Mean temperature	60 to 80 F	± 2 F
Relative humidity	40 to 60 percent	± 2 percent @ 40 percent

*Normal = 159 mm (3.1 psia).
§High-limit alarm setting (manual control).

As the table indicates, the specifications for the cabin simulator called for means of controlling atmospheric pressure over a range from sea level to the equivalent of 28,500 ft, although it is indicated that the tests will generally be conducted at half an atmosphere (18,500 ft). Note also that the specifications for oxygen, carbon dioxide, and carbon monoxide content are in terms of partial pressure, the true measure of physiological effects.

How Air Handling Equipment Is Designed

Fig. 1 is a schematic layout of the air handling system and control systems. Actual physical arrangement is indicated in Fig. 2: fan and filtering components below the floor; main cooling and dehumidification coil and electric reheat elements in the supply riser at the front end of the cabin (to be concealed by the instrument console); overhead distribution ducts on both sides, with multiple outlets for low register velocities (about 25 fpm); and dual return ducts with multiple inlets, at floor level, feeding into the return air header below the door sill.

Fig. 1 indicates a sampling bypass supplying the gas analyzers, with flow indicators in series (one in the instrument console and one in the outside monitoring panel) to assure adequate sampling flow. Another small bypass recirculates some of the air through a catalytic carbon monoxide oxidizer. A larger bypass around the chemical CO_2 absorption beds, with a motorized face damper at the inlet to the beds, controls CO removal.

The industrial type gas sensors and absolute pressure sensor are connected into electronic instrument circuits with continuous indication (and recording on a 12-point strip chart recorder) at the monitoring station. Indications are repeated on dials inside the cabin; but, in keeping with the psychological requirements, the systems are designed to permit laboratory technicians to check instrument calibration without disturbing the occupants.

Control point adjustments and setting indicators are also duplicated, with provision for external over-ride of internal settings, whether to correct pilot error or to establish scheduled experimental conditions.

All of the instruments, with one exception, include control action. If additional oxygen is needed, beyond the minimum constant boil-off from the three 25 litre liquid oxygen converters, an automatic valve is opened. An increase in carbon dioxide causes increased opening of the face damper ahead of the chemical absorption bed.

Scheduled altitude pressure is established initially by means of the evacuation pump indicated in Fig. 1. During a run, a rise in total pressure or an increase in oxygen above the set point starts the smaller "control pump" to evacuate some of the cabin atmosphere. A decrease in total pressure is corrected by valving inert gas from a pressure tank.

2 ACTUAL physical arrangement of environmental equipment is as follows: (1) overhead distribution ducts with multiple outlets, (2) supply riser, (3) electric reheat element, (4) main cooling coil, (5) absorbent beds and activated charcoal filter, (6) return air intakes, (7) fan, (8) electrostatic air cleaner, (9) return air heater

Since carbon monoxide production is expected to be minimal, manual control is considered adequate. If the monoxide alarm goes off, either the occupants or the outside observers can energize the electric heater in the catalytic monoxide filter to provide full oxidation.

More conventional elements in the system for controlling "composition" are the electrostatic air cleaner at the fan inlet, operating at reduced voltages to minimize ozone production and arcing at low pressures; and the activated charcoal filter after the other subfloor components, to remove odors.

Central Fan System in Miniature

One distinctive feature of this central fan application is the miniature scale. Consider as an illustration these estimates of heat production (given in Btu per hr):

OCCUPANCY (two men)
- Minimum (rest) 780
- Maximum (active) 1000
- Normal 900
  (Sensible 438, Latent 462)

EQUIPMENT
- Maximum possible (all full on) 12,000
- Normal probable 4,300

Nominal total load of something more than 5000 Btu per hr will seem small for a central fan system.

In this hermetically sealed steel chamber there can be no infiltration nor exfiltration of air or vapor. Hence the

latent gain will be entirely internal, with no external loss. With the cabin located in an air conditioned laboratory building, we should expect a cooling load only.

Preliminary studies considered the possibility of a requirement for humidification along with either heating or cooling to satisfy dry bulb control. The conclusion was that either of these conditions could be created only by a sudden change in set point of larger magnitude than foreseeable research programs would require. Hence, the system was designed for cooling and dehumidification, with reheat provided to prevent subcooling at low sensible-to-latent load ratios.

Atmospheric Pressure Affects Design

Sizing of system components involved considerations foreign to conventional air conditioning practice — notably the effects of atmospheric pressure on capacities of equipment and space. Consider, for example, the 50 to 70 percent increase in total heat (per pound of dry air) at a given temperature and relative humidity as total pressure is reduced from 14.7 to 4.7 psia (28,500 ft). (To facilitate calculations, the standard psychrometric chart was redrawn for pressures of 4.7 and 7.3 psia.) Thus, for one combination of other conditions, calculated coil capacity ranged from 18,530 Btu per hr at sea level pressure to 11,030 at 28,500 ft altitude pressure.

With a total air volume in the space of less than 300 cu ft, nominal fan capacity of 300 cfm yields recirculation equivalent to 60+ air changes per hr.

Peculiarities of the application such as this small space capacity caused some misgivings about the system's ability to respond to load changes in time. These were allayed by the results of analog computer studies and sample calculations of transients.

In addition, however, the designers took advantage of the insulated enclosure required for sound proofing (see Fig. 1) as a heat sink to provide a controllable transmission loss through the walls of the cabin. This arrangement throws a part of the steady state cooling load in the cabin on the fan coil unit in the insulated room. With a 4 to 6 F temperature difference (depending on cabin pressure) this transmission loss is estimated at 1050 Btu per hr. (The difference in U-factor for the cabin walls is due to changes in skin coefficient of the inner surface with pressure.)

Transient load changes, then, are compensated for by the internal system. But a lagged reset action adjusts the control point of an "outdoor" thermostat to increase or decrease the temperature difference, and therefore the transmission loss, with changes in the load.

A 3 ton brine chiller supplies the main coil in the fan system, a point-cooling coil behind the instrument console, the water treatment plant, and the insulated room unit. This capacity of 36,000 Btu per hr is estimated as sufficient to handle the maximum possible internal load on the cabin, plus the maximum load on the insulated room unit (1 ton rating) with the building air conditioning system out of operation.

The brine circuits supply brine at 15 F to the freezing coil of the water plant, at 40 F to the console coil and the above-freezing side of the water plant, and at variable temperature and continuous flow to the main cooling-dehumidification coil.

Referring to Fig. 1, the control sequence in brief is:

Electronic thermostat T_1 and relay R_1 position the modulating motor driving the variable transformer to vary the voltage on the electric reheat elements as required for dry bulb control. Electronic humidistat H_1 and relay R_2 position the modulating valve controlling the admixture of 15 F brine to the mixing loop. Through the "no-heat" auxiliary switch on the variable transformer motor, the thermostat can overrule the humidistat to prevent the latter (if satisfied) from reducing the cooling effect of the brine coil.

Dry bulb temperature deviation from set point, if more than transient, causes a reset signal to T_2 to raise or lower the control point in the insulated enclosure and thus adjust the temperature difference (and heat transfer) across the cabin walls.

Biggest Problems Are Yet to Come

It is hoped that experience gained in the use of this simulated space cabin will provide useful information on the engineering side, in addition to the biological data it was designed to help accumulate.

Nevertheless, a moment's thought makes it obvious that actual space ships will pose problems of air conditioning and mechanical engineering techniques that are but dimly foreshadowed by this application.

For one thing, zero gravity, a major factor of space environment not readily simulated in an earth-bound laboratory, will be of some concern to the air conditioning engineer. With no gravitational forces to produce free convection within the space cabin, forced convection will be essential. And this, in turn, will require some adjustment of basic data on body heat loss.

Problems of greater moment will be those associated with the input, utilization, and rejection of energy in a space ship exposed on one side to the radiant heat of the sun, unfiltered by atmosphere but varying inversely with the square of the distance, and on other sides to the infinite heat sink of nearly empty space. Enough has been published on the results of theoretical analysis and on experience with instrument-carrying satellites to invite at least brief speculation. Heat gain and loss will have to be balanced at some nominal base value by suitable means: perhaps by controlled orientation of the vehicle; perhaps by means of shielding. But some method of compensation for variations in internal heat production will presumably be required. What new techniques of "heat-pumping" will be developed? How would you go about providing an automatically variable means of dissipating excess heat from a building in a vacuum?

The engineering problems to be solved in this one area alone constitute a significant element of the fascinating challenge of space. ≠

Sectional Committee Interprets Code for Pressure Piping

SINCE the Code for Pressure Piping, ASA B31.1-1955, was last issued, the Sectional Committee on the Code has been asked to interpret various statements contained therein. While these Cases represent the opinion of the committee, they will not become parts of the Code until formal actions have been taken. The Cases published below cover the application of nodular cast iron piping components under certain sections of the Code, and the circumstances under which stress relief may be omitted on chromium-molybdenum steels. Three other Cases, published in previous issues of Heating, Piping & Air Conditioning (No. 9, October 1951; No. 24, January 1957; and No. 31, April 1958), have been annulled for the reasons stated.

Case No. 38 (Reopened)

Inquiry: May piping components made on nodular cast iron and to the dimensions of ASA Standards B.16.1, B.16b, and B.16.5 be used in construction under the jurisdiction of Sections 1, 2, and 3 of the Code for Pressure Piping?

Reply: It is the opinion of the committee that, pending the completion of studies now in progress in Sectional Committees B16 and B31, nodular cast iron components made of material conforming to ASTM Specification A395-56T may be used under the sections indicated in the inquiry under the following conditions:

1) Components whose dimensions conform to ASA B16.1 and B16b may be used at the following maximum pressure-temperature ratings at temperatures between -20 and 650 F.

Dimensions used	Maximum rating
Class 125 cast iron (B16.1)	80 percent of 150 lb carbon steel (B16.5)
Class 250 cast iron (B16b)	80 percent of 300 lb carbon steel (B16.5)
150 to 600 lb steel, inclusive (B16.5 or API 600)	80 percent of carbon steel rating

These ratings are applicable to values providing that the values in other respects merit these ratings. It is recognized that the components made to the Class 125 and Class 250 standards or to API Standard 600 may be thicker than those made to the 150-lb and 300-lb standards, respectively. In the case of these thicker components, the additional wall thickness may be considered as additional corrosion allowance.

2) Until further experience is developed, the pressure at operating temperature shall not exceed 1000 psi.

3) Welding of the components is not employed in fabricating them in an assembled system.

4) They shall not be used in lethal service, as defined in each of the Code sections indicated in the inquiry.

Case No. 41

Inquiry: Paragraph 632 Sub 4 is somewhat more restrictive than the requirements of other codifying bodies. Under what circumstances may stress relief be omitted on chromium-molybdenum steels?

Reply: It is the opinion of the committee that, for applications under Section 1 of the Code and under Paragraph 632 Sub 4, the following need not be stress relieved:

Chromium-molybdenum steels with a maximum specified chromium content of 3 percent and a maximum outside diameter of 4 in. and a maximum thickness of less than $\frac{1}{2}$ in. Circumferential joints in the pipe or tubes of the "P" No. 4 steels shall be preheated to 250 F-min. and the "P" No. 5 steels shall be preheated to 300 F-min.

Cases Annulled

Case No. 9, to eliminate inconsistency.

Case No. 24, as being incorporated in B31.8-1958.

Case No. 31, as being incorporated in B31.8-1958. ≠

Now's the Time to Brush Up on Your Hot Water Heating Fundamentals

Heating, Piping & Air Conditioning presents hereon the basic design and installation principles for hot water heating systems. The author, F. F. Stevenson, has called on his many years of experience in the heating field to compile this digest.

BY F. F. STEVENSON
Design Engineer

IN RECENT YEARS water has come into its own as a medium for heating and cooling. Water has an advantage in that its temperature can be widely varied, from 220 F down to 140 F. without difficulty. This is with reference to standard hot water systems as known in the U. S.

The heat of hot water ranges from about 100 Btu per lb up to 200. But a pound of water at 200 F has a specific volume of only 0.017 cu ft. To produce 1000 Btu of heat, a hot water system handles about 5 lb, or only 0.08 cu ft.

Today, hot water is being widely used in various ways for heating tall apartment buildings and similar structures. Hot water in such buildings is easy to control and the heat lag or storage effect of water can be used to good advantage.

Water is also being frequently used for air cooling and dehumidifying, especially in large installations. Its temperature and flow can be modulated very readily, its only disadvantage being the requirement for two heat transfers, water-to-refrigerant and air-to-water.

Many heating and cooling systems being installed today are using water for both heating and cooling, with the piping and heat transfer equipment doing double duty.

How Water Is Used

The various divisions of hot water heating are as follows: (1) radiators and convectors, (2) finned tube and baseboard radiation, (3) forced air or blast coils, (4) unit heaters, (5) radiant and panel heating, and (6) snow melting. For all these, the water temperature may be raised in a hot water boiler or a converter (using steam as the heating medium). The latter is used in many industrial systems.

For hot water radiation systems, the designer has the choice between two-pipe and one-pipe circuits. The latter arrangement may save piping costs if the heating circuit forms a loop, beginning and ending at adjacent locations. If the circuit runs along one or two walls and ends at a spot distant from the initial supply, the one-pipe circuit becomes a two-pipe system with a return line. In such installations, a two-pipe system with a reverse return may be used. A reverse return system not in the form of a loop may be really a three-pipe circuit.

A reverse return system makes balancing the flow comparatively easy. A reverse return system forming a loop is a two-pipe circuit.

Not Too Many Radiators

Care must be taken when laying out a one-pipe system not to put too many radiators on one circuit. The main takeoff fittings for one-pipe systems are designed to divert about 20 to 25 percent of the main line flow to the radiator.

One-pipe takeoff fittings are really resistances in the main pipe to synchronize the pressure drop in the main between the two risers with the drop in the radiator circuit. If the

radiators are used for the usual 20 percent temperature drop, each radiator causes an approximate 5 F drop in main line water temperature. For eight radiators, the water temperature drop will be about 40 F. This figure ignores the drop in the main itself.

So it will be observed that there is a definite limit in the number of radiation sections that may be installed in a one-pipe circuit. Radiators toward the end of such circuits must be sized for a lower temperature difference than those at the start. In circuits with eight or nine radiators, the last radiator may be 40 percent larger than the first. The increased size and price of radiation in a one-pipe system sometimes make it cost just as much as a return pipe system. High initial water temperatures should be used in one-pipe systems, starting at about 220 F.

Make Sure of Enough Pressure

With downfeed radiation on a one-pipe circuit, care should be taken to insure that there will be enough pressure in the system to force the hot water down against its natural bent of travel. An upfeed radiator circuit develops a material gravity pumping head which accelerates the flow up and then down. The difference in weight between the hotter water flowing up and the cooler water going down causes this circulation.

With downfeed radiation, the above conditions are reversed, with the upfeed riser having the greater static head. This head acts as a brake on the water flowing downward. Hence, increased pressure is needed for the downfeed radiation.

A rule of thumb is to add about 150 mil-in. per ft of drop to the normal pressure loss of a downfeed radiator circuit. With a number of downfeed radiators in a one pipe circuit, it may be necessary to use smaller pipe in order to increase the overall pressure. This will mean greater power required to operate the pump.

Normal practice in hot water piping indicates pressure drops between 250 and 600 mil-in. per ft. For smaller pipe this will give velocities around 1 to 2 fps. For larger pipe, velocities will go up to 4 to 6 fps, using these pressure drops. For quiet installations, however, water velocities should not run over 3 to 4 fps.

All supply lines should be pitched upward in the direction of flow. The pitch of piping is correlated with the location of air vents and water drains. With the pump running continuously, it is best to have all lines pitched upward as it is very difficult to vent air from water under a pressure induced flow in a pipe running downward. If it were not necessary to drain a circuit and if air were vented properly, the mains could be run horizontally.

With some types of circuits, running all lines pitched upward with flow will result in a non-uniformity of piping slope. In one-pipe circuits forming a loop, there is no trouble because there is no return. However, in one-pipe systems not forming a loop, or in direct or reverse return circuits, it may not be satisfactory to slope both the supply and return pipes upward.

Where to Locate Equipment

There are several reasons for putting the water pump in the supply line and pumping out of the boiler, especially if the return mains connect below the boiler level. However, with a converter it makes little difference, in most instances, whether the pump is on the return or supply side. Many systems are designed with the pump in the return line, pumping into the converter. If a three-way valve is used to bypass return water back to the supply line when the heating load is low, place the pump in the return line upstream from the bypass. Or, if pumps are in the supply line, place the pump downstream from the bypass.

Most large hot water heating systems today are the closed, forced flow type, with a compression tank which may be placed almost anywhere with respect to height (except, of course, in multi-story buildings). The compression tank, as its name implies, is a pressure temperature device which serves several purposes in the operation of the system:

1) It raises system pressure above atmospheric, so that temperatures over 212 F may be maintained without boiling the water.

2) It provides a static head for the system, so that water may be raised to a considerable height.

3) It provides a space cushion into which water may expand when heated and from which water may flow back to the system when cooled. This feature minimizes the use of relief valves, although such valves must be installed, ready for occasional use.

Compression Tank Vital

The compression tank is a vital part of a closed hot water heating system. The air cushion in the tank provides the pressure needed for the system and also a space into which the water flows when heated. It likewise becomes storage space for the air emitted from water as it is heated.

Assume a system with a system head of 14 ft and a 100 gal compression tank. When the system is initially filled with cold water, water flows into the tank and is trapped there. Before the tank is filled, the air inside is at atmospheric pressure. The tank must develop an air pressure of 20.8 psia to keep the water from flowing out of it as the upper parts of the system are being filled. With the initial pressure of 14.7 psia, a pressure of 20.8 psia will be developed at some point before it is completely filled. When the tank is one-third full, the air pressure is

$$14.7\ (100/66.7) = 22 \text{ psia.}$$

We see that the tank need be only a little less than one-third filled to develop the pressure required.

When water is heated, it expands from 3 to 6 percent depending on temperature rise. The additional amount flows into the tank. This compresses the air still further. Assume the tank is now slightly over one-third filled and the air pressure rises to almost 25 psia. This is good for about 23 ft of head. We note from the foregoing that the tank develops additional pressure as the water is heated. This system pressure is much greater than needed, so a larger tank should be used — a 125 or 150 gal size.

How to Size Tanks

The following formula for calculating the tank size has appeared in the Guide for a number of years:

$$V = E/[P_1/P_2 + 0.434\ (H)] - [P_1/P_3]$$

where:

V = size of tank, gal
E = expansion of water when heated, gal
P_1 = atmospheric pressure, normally 14.7 psia
P_2 = tank pressure required for the system, psia
H = system-height above tank, ft
0.434 = lb per ft of head.

A certain amount of excess pressure should be available at higher points in the system for air venting. Also a certain amount of air is continuously being lost from the tank. This should be allowed for as the air will wind up in the piping and radiation, especially at the high levels. Vents should be properly located.

Should the tank be insulated? No. It is better to keep the water in the tank on the cool side. Cool water expands less and keeps the tank pressure from going too high. Cool water holds more air than hot and water that is too hot will release air and increase the pressure.

Sometimes, however, it is desirable to release free air in that tank and warmer water is an advantage. After long periods of constant cycling of the water and air to and from the converter and tank, some systems lose air from their tanks and it becomes water logged. In this case the tank must be drained and air added.

More of the fundamentals for design and installation of hot water heating systems will appear in an early issue. ≠

Some of the data used in the discussion of tank location was obtained from literature prepared by Bell & Gossett Co.

SAMUEL R. LEWIS, consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally each month on practical problems in the field.

Sam Lewis says:

"We Must Have Air to Combine With Carbon for Heat Production!"

I PICKED UP an interesting angle on carbon monoxide poisoning that rubs a sore spot:

Many years ago I was summoned to find out why the boilers that I had selected for a big high school in another state couldn't generate enough steam.

I made the long journey under a cloud of apprehension, because I knew I had computed the loads correctly. The claim was that they could not burn enough coal. Soon after my arrival, I selected a substantial lump of coal, carried it outside and smashed it through the boiler room window. Neither coal nor wood nor oil nor gas will burn without the necessary air.

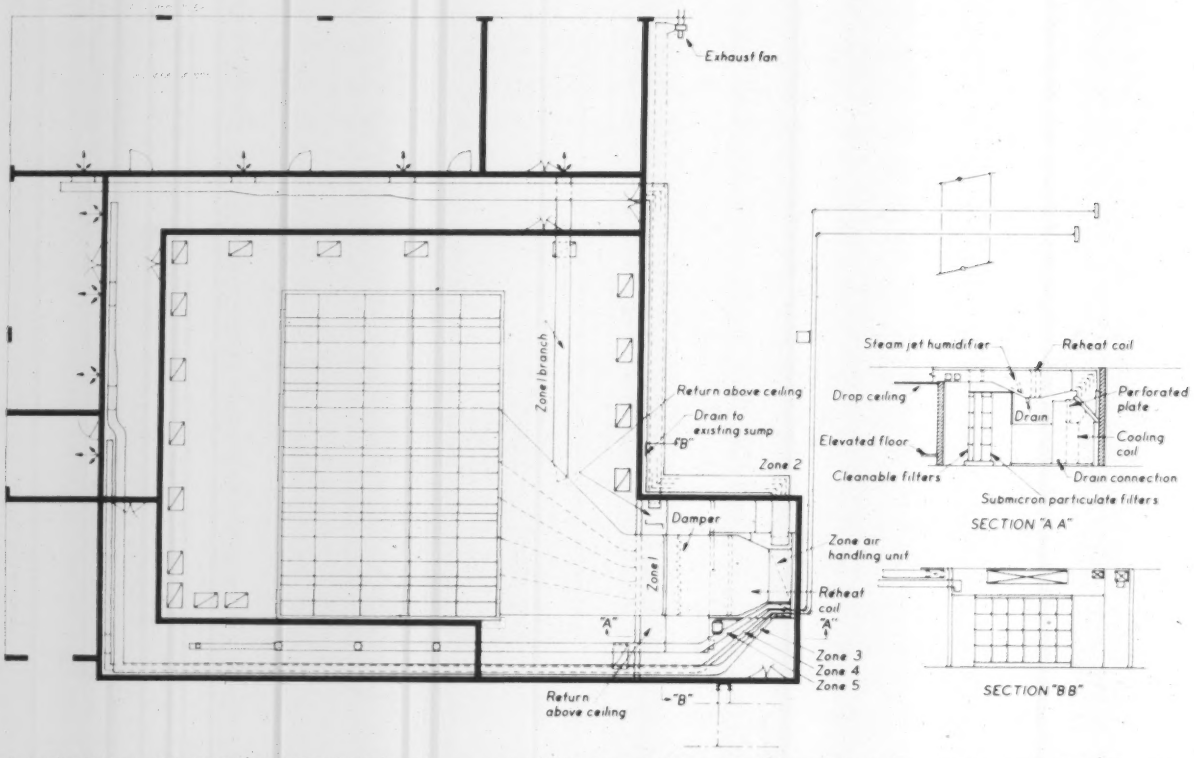
Recently a man and his wife were found dead in their large beautiful gas heated and cooled home. The verdict was that they had suffocated from inhalation of too little oxygen and to much carbon derivative.

The ventilating and cooling plant in the basement was fitted with an air inlet duct from out-of-doors, and with an electric driven fan to assure replacement, by outside air, of the air exhausted by the hot water heater, the kitchen range, fireplaces, etc.

While the owners were away last winter, a burglar had crawled through the lightly-protected outside air intake. A well-meaning person, following routing of the burglar, installed a thoroughly secured and very tightly fitted steel plate over the outside air intake.

The owner returned during warm weather and placed the air supply fan and the air cooling system in operation without opening the sealed-off outdoor air intakes. The air supply fan, unsatisfied with outside air, grasped whatever it could through sources contaminated by imperfect combustion of fuel.

Let me never fail to practice and to preach that we must have air to combine with carbon for heat production! ≠



1 UNUSUAL COMPUTER INSTALLATION operated by Air Material Command shown above. Supply air enters through center section of ceiling which is made up of perforated plate diffusers and light fixtures. Supply section is separated from return section by short suspended partition (see Fig. 2)

Design Electronic Data Processing Installations for Reliability

● Cooling electronic data processing equipment (EDPE) requires careful design to provide closely controlled temperature and humidity limits, good air distribution, filtering of the air, as well as other factors. The Air Force is a big user of this equipment and certain design criteria has been established for these systems, as presented here.

Mr. Goes has 20 years' experience in the heating, ventilating, and air conditioning field, the past eight of which have been with the engineering branch of the Air Force's Air Material Command.

By RICHARD W. GOES
Mechanical Engineer
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ELECTRONIC data processing equipment, commonly referred to as "EDPE," has become firmly established as a valuable tool to the Air Force during the last few years. The Air Material Command, with its vast network of procurement and supply facilities, has realized enormous benefits from its use through simplification and reduction of warehousing requirements. EDPE facilitates simplified and reduced warehousing requirements, providing instantaneous review of stock records and consequent speed-up of its worldwide function of procurement and supply.

In general, air conditioning equipment for these EDPE installations is supplied by many manufacturers in

This job is just one more example of how air conditioning — installed at only a small fraction of the cost of the equipment it protects — pays for itself many times over

two types: One has integral heat exchangers supplied from a central water chiller which also supplies water for cooling and dehumidification of the entire area occupied by the facility. The other is equipped with fans which pull room air from the immediate vicinity, through the equipment via intakes in various locations and introduces the air into the general area through top discharge outlets.

The greatest environmental problems by far, are presented by the latter. This article will be limited to discussion of this type.

Mix Discharge Air with Conditioned Supply Air

The discharge of the warm equipment air in an upward direction must be satisfactorily mixed with conditioned supply air or else disposed of in order to provide a suitable quality of air for entrance to the EDPE. It has been the Air Material Command's experience that the central processing unit is the primary target to be satisfied, and in the vicinity of this most critical item is usually found a hot spot.

The effects of this hot spot upon the entrance condition of air to this unit can be the source of much unfavorable criticism of the entire facility. If the temperature and humidity of the air to this item of EDPE is adequately maintained and the condition of air in the remainder of the area is controlled within the required limits, little difficulty will be experienced with the entire installation so far as equipment operation is concerned.

The central processing unit is unfortunately so manufactured that part of the discharge air from it and surrounding EDPE is shortcircuited to the air intake with the consequence that temperature readings taken at the intake can vary 10 F from top to bottom.

The installation shown in Fig. 1 receives its cooling medium from a centrifugal water chilling unit and air is distributed by a hot and cold deck fan-coil unit.

Because of the expected high temperature of the return air and the normal damper leakage and radiant effect of the heating coil, a perforated plate was substituted for the hot deck coil to equalize pressure drop. A reheat coil was then placed in the supply duct for Zone No. 1. All other zones depend upon mixture of dehumidified and return air for environmental conditions.

Zone No. 1 air supply enters through the central portion of the ceiling which is made up of perforated plate diffusers and light fixtures and is separated from the return section by a short suspended partition. This air is discharged at a set temperature since definite temperature rise within this area can be predicted to remain within the tolerable limits. It is then picked up by the fans which are a part of each piece of equipment and discharged from the equipment top, then picked up at the return grilles in the ceiling at the periphery of the installation and returned to the fan-coil unit. Return air from other zones is carried through the underfloor plenum.

Shortcircuiting Exhaust Causes Annoyance

In the original design calculations, it was estimated that a 74 F discharge temperature at 50 percent RH would be required to maintain a satisfactory entrance condition to the equipment. Owing to the air inlet location (along two sides of the central processing unit reaching from the bottom to top) the air temperature into the machine averaged approximately 80 F due to shortcircuiting of the exhaust air from the top of this unit.

While this was still within the limits set by the lessor of the equipment, it was considered marginal. To obtain a greater safety factor, the discharge temperature was lowered to 70 F, where it is now operating.

To prove that recirculation of exhaust air was causing the annoyance, makeshift shields were fitted to the unit to prevent this recirculation. The results proved excellent, but this measure was only temporary as the machines are now performing without shields.

Another method of improving the installation would have been to cut down the side inlets of the central processing unit and intall a duct to an inlet in the underside of this item where provision has been made for such installation if desired. With greater ceiling height, a more conventional installation with air discharged over the entire area has proved satisfactory.

This article is based on a paper presented by Mr. Goes at the recent U.S.A.F. Refrigeration and Air Conditioning Equipment Conference held at Wright-Patterson Air Force Base.

The Air Material Command (AMC) has had success with perforated plate diffusers as well as the higher volume type outlets strategically placed to provide complete mixing of the up-to-100 F EDPE discharge air with the conditioned supply air to provide a satisfactory room condition. However, all EDPE facilities have one thing in common—some hot spots. These can be kept within the limits of comfort and the limits set by the manufacturers of the equipment.

What an Installation Should Include

The requirements of a satisfactory installation might be as follows:

1) *Reliability of the entire environmental system.* The environmental requirements, although having a wide tolerance, have rigid limits, which, if violated, permit the lessor to close down the facility. The rentals run into five and six figures per month, so shutdowns are costly. The lessor maintains resident service men at the installations for maintenance of this equipment. They keep a close watch on temperature and humidity. Thus, ease of maintenance becomes a primary requisite. This can be achieved by providing good but simple equipment and controls, arranged for the best and earliest possible access.

2) *Proper air distribution.* With the high equipment heat loads imposed on the cooling system it is necessary to provide large quantities of supply air. The temperature rise through the EDPE given by the manufacturer approximates 15 to 20 F. With room temperature maintained between the limit of 70 and 80 F and equipment discharging air from the top at 85 to 100 F, it becomes evident that air distribution is a major problem. This is the best argument for underfloor distribution. However, in the opinion of AMC, this advantage is not sufficient to over-ride the disadvantages:

a) Underfloor ducts can cause loss of the flexibility to move the computers which the using agency insists upon.

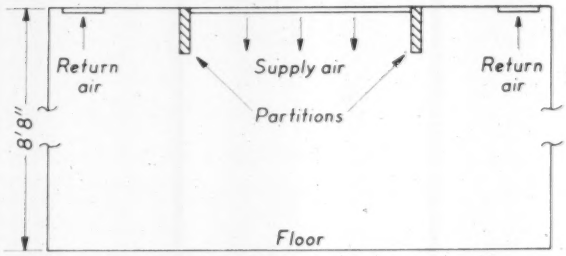
b) Underfloor ducts increase installation cost.

c) Underfloor ducts require increased height for the raised floors, thus cutting down on the available ceiling height which is usually limited since all EDPE facilities operated by AMC are in reworked existing buildings.

d) Underfloor supply plenums add to the dirt and dust problems. Excessive leakage, due to numerous floor openings and removable panels, is also a problem.

3) *Raised floors.* Raised floors are required due to the electrical wiring and cables which are a part of these installations. To enable ready access, the floors are installed as removable panels. In many installations, floor panels are hardwood resting on wooden or steel supports which have been shimmed up to provide a level floor. Today, commercially prefabricated floor installations with leveling jacks, stringers, and vinyl or rubber tile covered removable panels are available. The hardwood floor panels and makeshift supports leave much to be desired. Therefore the commercial floors are used most often.

4) *Recording instruments.* Recording instruments within the EDPE area are a requirement. These should be the non-electric type so that temperature and humidity will be recorded even if a power failure occurs. If the permissible limits of temperature and humidity are violated, certain maintenance procedures are required by the EDPE service personnel.



2 ELEVATION VIEW of computer room indicates short partitions (approximately 12 in.) extending from ceiling to deter shortcircuiting of supply air to returns

5) *Minimum outside air.* For an operation such as the EDPE facility, AMC does not favor the normal Air Force provision for 100 percent outside air for the following reasons:

a) Difficulty in preventing excess outside air leakage. When maximum outside air dampers should be closed, this excess leakage will add to the total load during periods when maximum cooling is required, thus adding to the design capacity requirements of the equipment.

b) Provision for 100 percent outside air will add to the maintenance and operation costs of the filters.

6) *Provision for minimum traffic.* Heavy traffic is a source of dirt and dust. Once created or brought into the EDPE room, it must either be removed by housekeeping means or by the filters. In either case, much of the dirt and dust becomes airborne and tends to diminish the full advantage of the submicron particulate filters and represents potential maintenance requirements for the EDPE.

7) *Well-constructed enclosure.* In this same category of dust problems is the building with structural members exposed or with poorly constructed ceilings which allow dust and dirt (which will accumulate in time) to drop or sift down into the EDPE area.

8) *Ramps.* Since the EDPE must be mounted on a raised floor and raised floors are expensive, their use should be held to a minimum. Ramps are normally required between the storage and service areas and the EDPE area. Machines must be removed from the EDPE areas to the service area for maintenance, and tapes must be transported between the EDPE area and the tape storage room.

Must Design for Easy Maintenance

A closing note: A reliable system must provide for easy and simple maintenance. Every system will require maintenance at one time or another. The more the designer considers the maintenance man's problems, the more reliable systems he will design. ±

Pumping Solids through a Pipeline

BY JULIAN NARDI
Chief Mechanical Engineer
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PUMPING solids through a pipeline is not new. However, it is not as universal as pumping homogeneous fluids like water, natural gas, and petroleum products. The main reason is that it is much more difficult to do successfully. Also, until quite recently, other means of transportation were more economical.

The power required for pumping depends, of course, upon the pressure required to force the slurry through the pipeline. This, in turn, depends upon the topography of the pipeline and the friction coefficient of the slurry in the pipe. The distance between pumping stations depends upon the maximum acceptable pressure developed at the pump discharge and in the pipeline. This pumping station spacing is also affected by the differences in elevation of the stations and the pipeline.

Here are a few of the things it is necessary to know before you can design a pipeline to pump solids:

1) Physical characteristics of the solid:
   a) Specific gravity
   b) Friability, grindability, and attrition rate
   c) Size and shape of particles (effect on settling rate)
   d) Screen analysis ratio of various sizes before and after grinding and screening
   e) Characteristics of fines in suspension (slimes)
   f) Wetability (surface tension)
   g) Solubility
   h) Chemical stability in air and/or water.
2) Physical characteristics of the slurry:
   a) Apparent viscosity and specific gravity at various densities and size ratios of solids
   b) Effect of temperature and pressure (solubility and apparent viscosity and specific gravity)
   c) Effect of agitation (thixotropic characteristics)
   d) Hydrogen ion concentration
   e) Gases in suspension
   f) Chemical stability of slurry
   g) Friction head or loss at various velocities, densities, and size ratio of solids
   h) Critical or minimum velocity for various densities and sizes of solids
   i) Angle of repose of solids in slurry
   j) Rate and degree of separation (dewatering).
3) Design data:
   a) Total distance solids are to be pumped
   b) Topography of route between terminals
   c) Quantity or rate of transporting solids
   d) Quantity and quality of water available
   e) Power required to pump slurry
   f) Spacing between pumping stations
   g) Maximum or optimum desirable pressure, both pumps and pipeline
   h) Type of pump and drive suited for conditions
   i) Availability of pumps best suited to specific slurry
   j) Erosion rate at various densities on:
      (1) Pumps
      (2) Pipe
      (3) Preparation equipment
      (4) Drying equipment
   k) Chemical treatment required to:
      (1) Minimize corrosion
      (2) Minimize friction loss
      (3) Minimize dewatering, drying costs
      (4) Clean drying plant effluent (water)
   l) Flushing and/or drainage facilities
   m) Dampening and surge requirements
   n) Storage and reclaiming.

Large lumps can be transported short distances if the specific gravity of the solid is not too much greater than the slurry. Small size solids can be transported long distances by using intermediate or booster pumping stations.

Chemical additives are essential to minimize corrosion and erosion, keep the solids in suspension while in transit, separate the solids from the water at the terminal and clean or purify the effluent water.

A pipeline is more economical than the usual means of bulk transportation only when large quantities, many years' useful life, high annual load factor, and relatively long distances are involved, or when some unusual or special circumstances exist. The cost of preparing the slurry for pumping and dewatering it at the terminal often exceeds the cost of transportation.

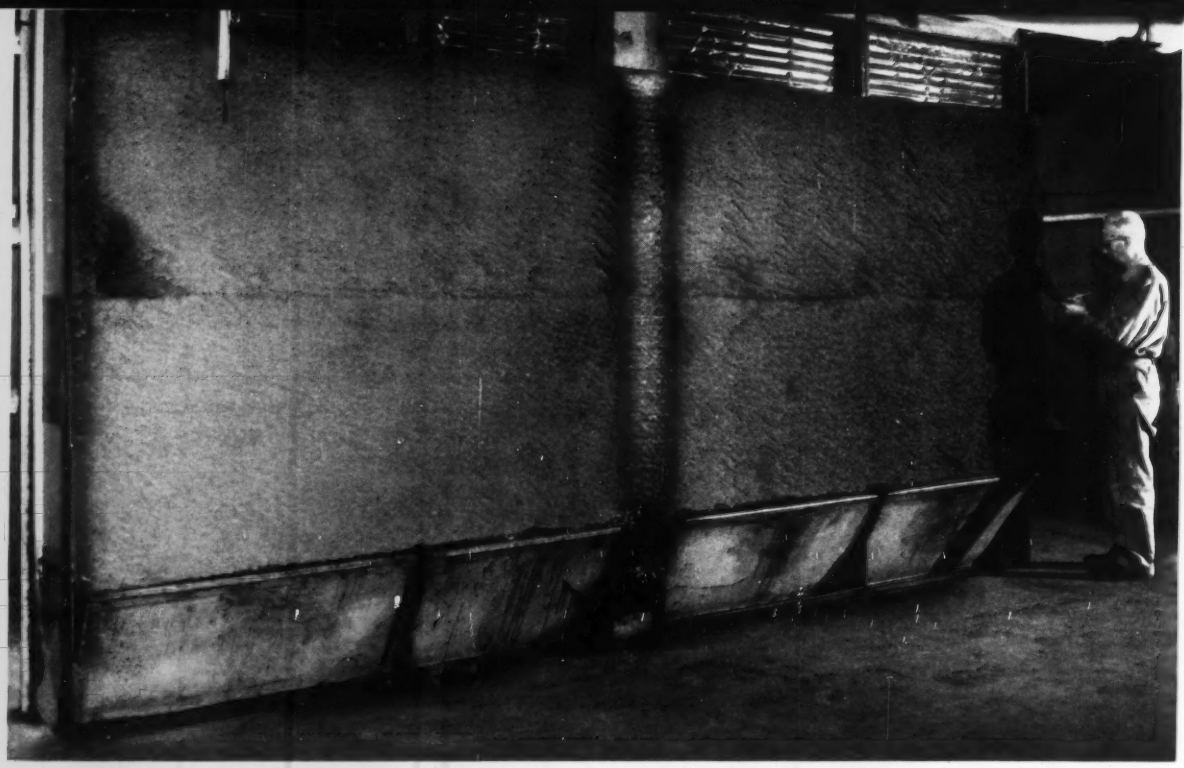
The successful operation of a pipeline for transporting solids requires considerable technical skill, especially at the start. Instrumentation can replace a certain amount of this skill after the effect of all the variables has been ascertained and the optimum operation established.

Pipeline transportation does have two basic advantages over railroads and trucks: a smaller portion of its operating costs is in labor and materials, both of which are apparently on an upward price trend (spiral); and the cost of returning empty containers is eliminated.

The partial processing of a solid while in transit in a pipeline might be the key to a whole new line of products which could be economically pumped through a pipeline.

However, in contemplating a solids or slurry pipeline, I strongly recommend: first, a thorough check of the economics; then, utilize all the best technical data and talent obtainable; last, allow plenty of "lead time" between the economic justification and the anticipated commercial operation. ÷

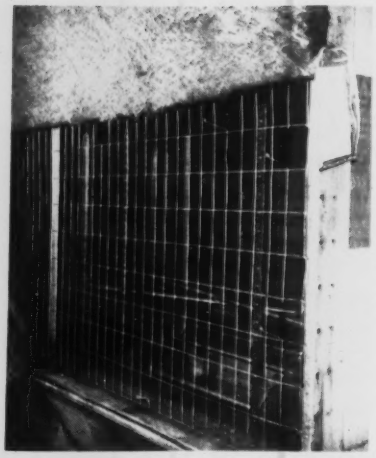
This article is based on a paper presented at the recent Cleveland convention of the American Society of Civil Engineers.



CONTINUOUS MOVING FILTER BANK was easily adapted to use stationary disposable material. Stationary frame test results indicated that filtering material would have to be changed only about once every four months throughout plant

INDUSTRIAL VENTILATION:

Disposable Air Filters Save Plant $50,000 in Installation Costs



THIS SECTION of disposable filtering material has been removed to show simple method of using wire fencing to hold material

• Industrial air filtering requirements vary considerably with geographical location, manufacturing arrangements, and the methods being used to prevent local dispersion of dust from various processes. At General Electric Co.'s Evendale, Ohio, plant, tests proved the effectiveness of viscous impingement disposable filtering material to meet the needs of this particular installation. This arrangement, of course, may not be practical for all plants—neither can every user be guaranteed the installation and operating cost savings obtained here. However, it does show that simple and inexpensive methods can be applied successfully, and these can be evaluated through careful investigation of all possibilities and testing in actual plant operating conditions.

C. F. Mowrey is a registered professional engineer with over 30 years' experience in design and installation of air conditioning systems. Currently, he is a consultant to GE in the use, improvement, and expansion of air conditioning systems, and the solution of complex production, processing, and testing requirements for air conditioning in the development and production of flight propulsion components.

BY C. F. MOWREY
Flight Propulsion Div.
General Electric Co.

At General Electric Co.'s Flight Propulsion Div., Evendale, Ohio, various factors made the reappraisal of the general air filtering system advisable.

The space above a floor area of 2.5 million sq ft was filtered by metal plate type moving curtain filters using oil as an adhesive. Although these filters had been in use for a number of years and were generally satisfactory, changed conditions made it advisable to seriously consider adding a considerable number of sprinklers for increased fire protection. As a consequence, two questions arose:

1) Was this particular filtering system indispensable?

2) Was there a practical adaptation that would meet requirements and also eliminate the need of additional sprinklers?

It appeared that, since there was no production process introducing large quantities of dust into the air, disposable filtering media might be satisfactory and might also eliminate the need for additional sprinkler protection.

An installation of the moving curtain type, utilizing viscous impingement disposable filtering material, had already been made at a new office building in the plant. The results in the offices during a year of use had been very satisfactory. Careful observations of the very slow increase in pressure across this material and the enduring characteristics of the adhesive indicated it might be practical to use this material in some manner for general filtering. According to calculations based on dust loading of the viscous impingement material and the sludge accumulation in the oil pans of the old filters, the viscous impingement material should last at least two months on stationary frames before reaching a resistance of 0.5 in. water gage.

Make Test Installations

Test installations were therefore made in the factory with the same filtering material. This comes in rolls 65 ft long and 3, 4, or 5 ft wide. When it is unrolled it quickly expands to a thickness of 2 in. or more.

It is built up of a mass of glass fibers averaging about 0.001 in. in diameter, but varying in diameter and quantity from front to rear in order to catch the dirt load evenly in depth. The ruggedness of the fibers and the irregularity of the surface minimize matting of the surface.

The entire filter is heavily impregnated with an adhesive of such characteristics that the filter is listed as Class II approved by the Underwriters Laboratories. Thus sprinklers are not required.

The stationary frame test results were entirely satisfactory, indicating that it would not be necessary to replace the filtering material more often than every four months, on an average, throughout the plant. It is significant that, in every instance, there was still plenty of adhesive on the back of the filtering material when removed from service.

Since developing a very simple and practical stationary frame for holding the filtering material (cut to size), we have installed frames for holding approximately 12,000 sq ft of material. At least 5000 sq ft has been in use for over a year, with very satisfactory results. The length of time between changes varies with the location of the filter and the quantity of outside air being admitted to the plant. However, the average effective period is at least four months. The fans are operated continuously, providing an average air velocity of 450 fpm across the filter surface.

Replace Packaged Units' Filters

It was decided to go a step further and use this material in the plant's packaged air conditioning units. These had been using 1 in. washable filters (good quality, all metal) which had to be cleaned on an average of once a month. A 1 in. metal frame was developed into which the 2 in. viscous impingement material could be easily placed. Since then, this system has been in use in packaged units totaling over 1000 tons of cooling capacity for approximately a year. Here, also, very satisfactory results have been obtained. The material is changed on an average of every three months of continuous fan operation.

Increase Filtered Area

The illustrations show the filtering material and the simple method of attaching the filter holders to the framework of the old metal panel type filters after the moving panels have been removed. This "fence frame" has been so practical and easy to apply that hundreds of square feet have been added at areas where previously the estimated cost had considerably outweighed the advantages of filtering.

At locations where no filtering had previously existed, the "fence frame" was fastened to simple iron framework installed for the purpose. Consequently, the total area served by this type of filtering here at the plant has reached 3.3 million sq ft.

The total installation costs were approximately $50,000 less than it would have cost to add additional sprinklers and supply lines. As for operating costs, the agreed-upon difference has reached a cost reduction rate of approximately $20,000 per year, with more applications in prospect.

It is not meant to infer that the filtering methods thus far described will produce the same results for all applications and in all locations. At this plant, many types of filtering equipment are in use, including electronic, all specified according to requirements. Too, plant conditions are such that there is relatively little lint in the air and the outside air is cleaner than in many industrial areas.

This installation simply bears out the fact that filtering requirements vary considerably with location, manufacturing arrangements, and methods of preventing local dispersion of dust from various processes.

Careful investigation and tests proved that the combination of these factors was sufficiently favorable to allow the development of very simple and inexpensive methods of filtering air for the general manufacturing and office areas. ±

the law and your profits

JOHN F. MORRISSEY, author of this regular feature, is an attorney at law and has an extensive practical business and legal background. This series is based on actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

Two Contracts, Mechanics' Lien Spell Trouble for Subcontractor

VARIOUS state laws generally provide that a subcontractor shall have a lien on any property for which he furnishes labor or material. The right to the lien is, however, generally dependent upon a notice of lien to the property owner within a specified period of time after the final labor or material is furnished.

Both contractors and subcontractors should be familiar with their particular state requirements concerning the time within which notice should be given. Even familiarity with the appropriate law does not, however, always insure success without difficulty, as is illustrated in the following case:

O. Traveler Co., a general contractor, contracted for the construction of a new plant for Tostep Mfg. Co. On June 3, pursuant to an order from Traveler, John Singles, a subcontractor, delivered piping material to the site. About the end of June, Traveler called Singles and placed with him an additional order for heating and related equipment which, it was understood, was to be installed as the plant's heating system.

Singles received no payment for any of the delivered material. On August 15, he served notice of a mechanics' lien upon Mr. Tostep, the building owner.

After a few months, Singles' attorney filed the appropriate court action to enforce the mechanics' lien. Both Traveler and Tostep were named as defendants but Traveler, it seems, had moved his operations to another state and he, being served by publication, did not appear to defend.

Tostep contested the action before a jury. He did not deny that the mechanics' lien was valid as to the heating equipment, but contended that the lien was invalid with reference to the piping material.

He argued that he had made two contracts with Traveler, the first for piping and the second for heating. He cited state statutes which required notice of mechanics' lien within 60 days after the last quantity of material is delivered under a contract. He contended that the notice was not served within 60 days after delivery under the first contract.

The trial judge, over Singles objection, instructed the jury that if they found from the evidence that Traveler and Tostep entered into two distinct contracts, and if they found also that one of the contracts was completed before the other was begun and that notice of lien was served upon Tostep more than 60 days after the last quantity of material was delivered for the first contract by Singles, then, in such a case, Singles could *not* recover for the material delivered under the first contract.

The jury returned a verdict in favor of the defendant, Tostep.

Singles appealed to a higher court and assigned as error the lower court's instruction to the jury. The higher court held that even if it were conceded that the evidence established two separate and distinct contracts between Traveler and Tostep, Singles' right to recover from Tostep could not be defeated.

The higher court stated that Singles delivered all the material without any claim that there were two contracts between the defendants. Singles had no notice that the material he delivered was to be related to anything other than a single contract. Both the piping job and the heating job were done on the same building for the same owner, and if the heating plant were the second job, it properly came under the provision of "extra or additional work and material" mentioned in the state statute and for which both the contractor and the subcontractor were entitled to their liens—the same as for the original work and materials contracted for.

The Court held that the last date of delivery is the date from which the 60 days is reckoned and that it was erroneous for the lower court to have given the instruction to the jury.

Although Singles ultimately won out and the law is, perhaps, more settled on the point of contention now, it would seem that a subcontractor cannot be too alert to the possible difficulties in which Singles found himself. ±

Steam Pipe Sizing Data

THIS IS THE fourth and concluding HPAC Data Sheet in a monthly series presenting tabular information for use in sizing steam piping for low pressure and vacuum steam heating systems.

All tables are based on dry steam flowing through Schedule 40 steel pipe. The Moody Friction Factor has been used in computing pipe capacities and friction losses.

Table 4, on the next page, is a tabulation of friction losses per 100 linear ft of pipe, or the equivalent. It is based on an initial pressure of 2 psig and may be used for branch piping calculations in preference to Table 2 (July). With Table 4, pressure losses can be determined more accurately than is possible with Table 2. Also, pressure losses may be calculated for conditions different from those covered by Table 2.

Let's briefly review Tables 1, 2, and 3:

Tables 1 and 2 (June and July) are based on a maximum pressure drop of 3½ psig, or 56 oz, from the start of the supply main to the farthest heating surface. They are to be used only for sizing piping where steam and drips flow in the same direction.

For a given system, the sizing of the steam supply piping requires the use of *both* Tables 1 and 2. Table 1 (June) is for the steam mains and is based on a maximum pressure drop of 2½ psig, or 40 oz. Table 2, for the piping between the supply mains and the heating surfaces (i.e., branch piping, risers, and runouts), is based on a maximum pressure drop of 1 psig, or 16 oz. It should be noted that the 16 oz pressure drop is *in addition* to the 40 oz drop in the supply mains.

Table 1 is based on an initial steam pressure of 5 psig, whereas the initial steam pressure in Table 2 is taken at only 2 psig to allow for a pressure drop in the mains. The initial pressures were selected as representing average conditions normally encountered in low pressure steam heating systems. Small variations from these initial steam pressure conditions will not materially affect the values in the tables.

Table 3, (July and August) is a tabulation of friction losses per 100 linear ft of pipe, or the equivalent. It is based on an initial pressure of 5 psig and may be used in preference to Table 1.

This data is published through the courtesy of the Nash Engineering Co.

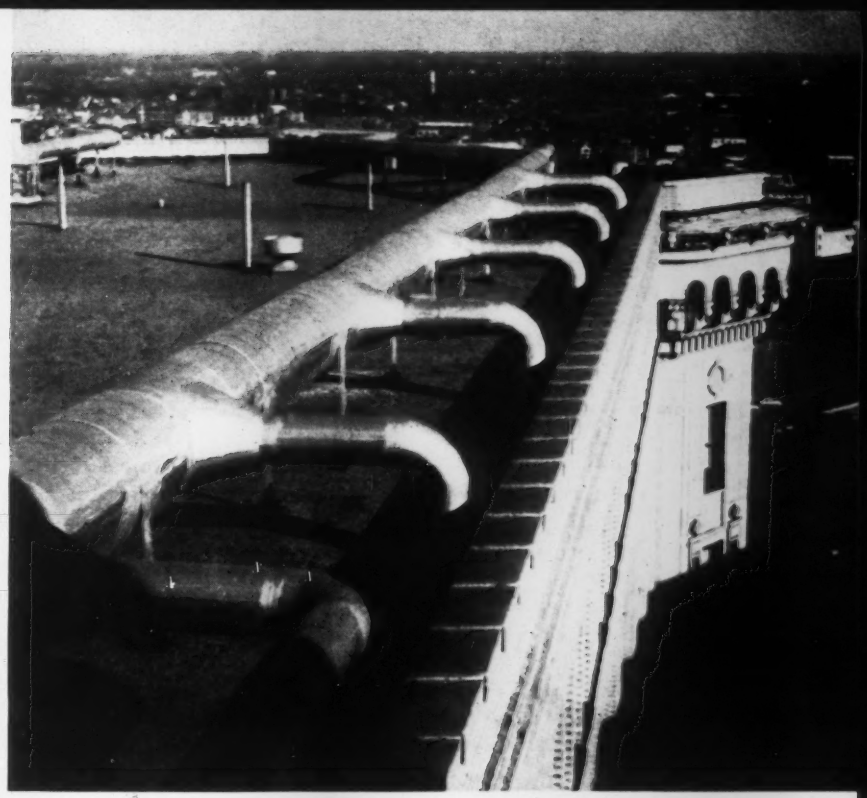
TABLE 3—FRICTION LOSSES in ounces per 100 linear ft of pipe in sizes 1 in. to 3 in. are tabulated below. Data is based on steam at 2 psig initial pressure and may be used for branch piping calculations. Pipe is Schedule 40 steel. Loads are in square feet of equivalent direct radiation and in pounds per hour. Velocities may be calculated by using factor at bottom of page.

PRESSURE LOSS OUNCES - PER 100 FEET OF STEEL PIPE							
LOAD SQ.FT.EDR	PIPE SIZE - INCHES						LOAD LBS.PER HOUR
	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	
50	.60						13
75	1.21						19
100	2.05	.54					25
125	3.07	.80					31
150	4.27	1.12	.54				38
175	5.7	1.48	.70				44
200	7.2	1.88	.89				50
225	9.0	2.33	1.11				56
250	10.9	2.83	1.33				63
275	13.2	3.35	1.59				69
300	15.4	3.92	1.86				75
350	20.6	5.2	2.47				88
400	26.5	6.7	3.15	.92			100
450		8.3	3.90	1.14			113
500		10.0	4.75	1.38			125
550		12.0	5.6	1.64			138
600		14.1	6.6	1.91			150
650		16.4	7.7	2.22			163
700		19.0	8.8	2.55	1.06		175
800		24.4	11.4	3.27	1.35		200
900			14.1	4.05	1.68		225
1000			17.2	4.93	2.04		250
1100			20.6	5.9	2.43		275
1200			24.3	6.9	2.85		300
1300			28.3	8.1	3.32	1.14	325
1400				9.3	3.81	1.30	350
150				10.6	4.31	1.48	375
1600				11.9	4.89	1.66	400
1700				13.4	5.5	1.86	425
1800				14.9	6.1	2.07	450
1900				16.6	6.8	2.28	475
2000				18.2	7.5	2.51	500
2200				21.8	8.9	3.00	550
2400				25.8	10.6	3.53	600
2600					12.3	4.08	650
2800					14.1	4.73	700
3000					16.1	5.4	750
3200					18.2	6.1	800
3500					21.6	7.2	875
4000					27.9	9.2	1000
4500						11.5	1125
5000						14.1	1250
5500						16.9	1375
6000						20.0	1500
6500						23.3	1625
7000						26.8	1750

VELOCITIES

TO OBTAIN VELOCITY IN FEET PER MINUTE, MULTIPLY LOAD IN SQ. FT. EDR BY PROPER FACTOR SHOWN BELOW:

	PIPE SIZE - INCHES					
	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"
FACTOR	16.50	9.52	7.03	4.25	2.98	1.93



HIGH VELOCITY HEADER on rooftop has glass foam insulation, with weatherproof covering of aluminum jacket

Year 'Round Air Conditioning Brings Existing Office Building Up to Date

BY RONALD L. MOORE
Senior Application Engineer
Carrier Corp.

BEING ANTIQUATED before its years by surrounding structures, Hurt Bldg. found air conditioning the answer to its modernization problem

THE Hurt Bldg., Atlanta's largest office structure, was brought up to today's office standards with the recent installation of year 'round air conditioning. When its comparatively young 35 and 45 year old sections were prematurely outmoded by surrounding buildings, 85 percent of which were completely air conditioned, the Hurt management decided that modernization via air conditioning was necessary to provide efficient working conditions for the building's some 3500 occupants.

After careful study, a high velocity, high pressure induction system was selected. This was to be supplemented by a low pressure system for interior offices. This combination was

Combination high velocity, high pressure induction system supplemented by low pressure interior system heats and cools 374,000 sq ft of rentable office space. Installation was made for only $3.20 per sq ft; first full summer's operating cost was just 9 cents per sq ft.

determined most economical for this application because it would offer the following advantages:

1) Require less space for primary air equipment

2) Provide good dehumidification and ventilation control

3) Offer individual unit control

4) Neutralize downdrafts from windows.

Cost to the owner was $2.40 per sq ft of rentable floor space, exclusive of general construction and electrical work. When these costs were included, the final cost was $3.20 per sq ft, or $991 per ton of cooling capacity.

Replace Existing Equipment

A survey of the building revealed miscellaneous self-contained and direct expansion systems with cooling capacity totaling 485 tons already installed.

An economic analysis, which considered the age of existing equipment and the amount of occupied space in comparison to the proposed central refrigeration plant, indicated to the owner the need of replacing the existing apparatus with a central chilled water system to serve coils in all-air handling equipment.

Each phase of the job was engineered a number of ways to determine the most practical and economical method commensurate with good design and construction techniques. The reasoning that went into the decision for handling these major aspects of the project follows:

- **Cooling Plant:**

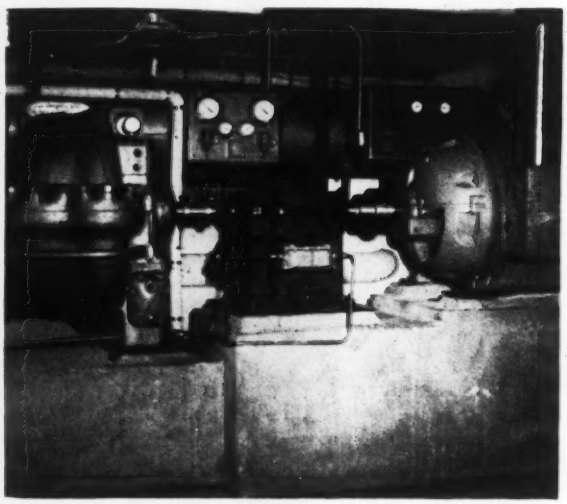
The centrifugal refrigerating machines with 400 and 800 hp wound rotor motors are located on the roof. Utilization of the basement area was not feasible. Southern Bell Telephone and Telegraph Co., a major tenant, uses approximately half the underground level for classrooms and storage. Additional basement space is shared by a bank and by a restaurant occupying the street floor, plus hot water heating equipment and its accompanying storage tanks, pumps, piping, electrical switchgear, and locker and rest rooms for the 120 or so building staff employees.

The upper level placement of the equipment made it unnecessary to install 225 ft long condenser water pipe runs. The basement continues as a revenue-producer.

An economic and operating analysis pointed to series chilled water flow through the refrigeration units. The smaller centrifugal takes advantage of a higher suction temperature, made possible by the warmer return water and its higher than normal leaving water temperature, to give low brake horsepower per ton. The larger machine completes the team by lowering the chilled water temperature to the design value.

When the load is low enough so that either machine carries it by itself, the other machine is shut down

INTERIOR VIEW of primary air equipment penthouse shows part of air conditioning assembly, one primary air fan



CENTRIFUGAL REFRIGERATION machines supply 1200 tons of cooling. Note vibration isolators under concrete base

without requiring the suction temperature of the one operating to drop far enough to offset the effect of water bypassing through the idle unit, as would be required for parallel water flow.

Part of the first phase of the modernization program included installation of 11 electronically operated elevators. This left four shafts vacant. The strong steel framing which had originally held elevator hoisting equipment is now used to support the refrigerating machines.

A concrete floor was poured over the existing shafts, and the units, together with their foundations, ride free on spring vibration isolators. Chilled and condensing water pumps are also spring mounted in the same room, preventing vibration in occupied spaces on the floor below.

TABLE 1 — OWNER'S COSTS for air conditioning Atlanta's Hurt Bldg. are tabulated below. Amounts are based on 374,000 sq ft of rentable area and 1200 ton cooling capacity

Equipment and installation	Cost per sq ft	Cost per ton
Refrigeration equipment	$0.57	$115
Induction system air side	0.74	250
Low pressure aft side	0.42	130
Cooling tower	0.06	18
Piping and pumps	0.63	195
Controls	0.07	20
Insulation	0.11	35
General construction work*	0.63	196
Electrical work	0.17	54
Totals	$3.20	$991

*Performed by Hurt Bldg. personnel.

• Rooftop Conditioning Plant:

The elevator penthouse was enlarged slightly to house the centrifugals and their pumps. At the same time, the roof was raised another floor to exactly match the existing elevator penthouse, providing a neat esthetic appearance. The second story also provided an area for the primary air treating equipment, serving the exterior zone high velocity induction system, which is the largest user of chilled water.

Steam services from the basement terminated close to this area. This combined to provide the shortest possible chilled water and steam piping connections, as well as the most economical grouping of steam consuming equipment. Insulation costs were similarly reduced.

Instead of splitting the air handling apparatus into two systems housed in small shelters atop major wings of the building, a single installation of two fans, two spray coil dehumidifiers, and two banks of reheaters serves the 1390 under-window units in the north and south zones. This makes maintenance simpler and less expensive, and the number of components has been halved.

Secondary water pumps and steam-to-water heat exchangers for winter operation (both located in one penthouse) have similar zoning arrangements. This makes it possible to switch one zone to heating while the other may require cooling, a frequent occurrence during spring or fall. An estimated saving of $5000 resulted from the single installation.

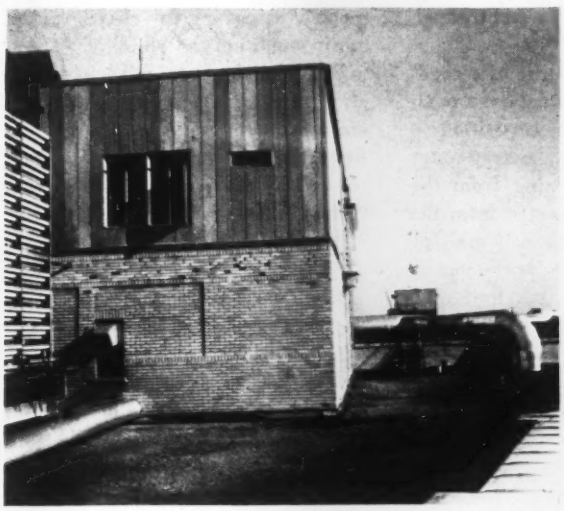
Similar compactness of design was applied to installation of the interior zone system. Factory assembled central station units serving each floor were placed at the ends of elevator lobbies. By locating these units here, no rentable space is used. Short outside air connections were made through existing double-hung windows, thus affording maximum economy in running supply lines. Outside air screens, louvers, and dampers are in the upper half of one of the two windows.

Return air has a simple path. It travels through office transoms, into corridors, and through a grille on one side of the central station equipment room. This compartment serves as a plenum. Outside and return air enters the conditioner through separate banks of permanent type filters.

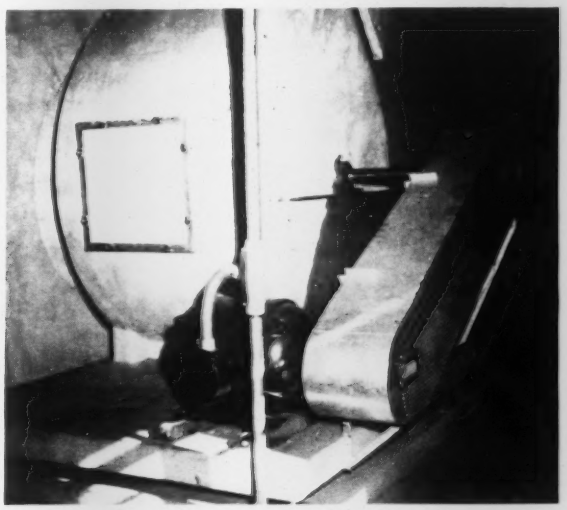
• Ductwork:

All interior zone supply ducts run exposed except those in corridors which are furred in. A premium was paid to install the distribution system at night. However, costs were about normal due to the following savings:

1) Crews were unhampered; they did not have to "work around" office people.



NEW AIR CONDITIONING equipment room was built on top of penthouse which houses refrigeration equipment



ONE OF TWO primary air handling fans which supply 1390 under-window units shown here

"By metering air conditioning utilities separately from other building services, operating engineer knows exactly how much it is costing to operate."

2) Repetitive layout arrangements, designed for minimum alteration due to relocation of partitions, reduced lost motion.

3) Ductwork from existing systems was used wherever possible.

4) Galvanized iron ducts of simple "S and drive" construction were run exposed, but painted the color of the ceiling.

To limit space used by vertical risers around the perimeter of the building, the risers were sized for velocities up to 5000 fpm with a maximum diameter of 9 in. To deliver the same air quantities at conventional velocities using an all-air system would have necessitated 24 in. diameter ducts.

Headers for primary air were installed in a 6 ft high attic which is available over half of the structure. Where this "pipe loft" was nonexistent, the headers were run outside along the roof. Glass foam insulation, protected by a weatherproof aluminum jacket, covers exposed ducts.

Sound generated by fans in the penthouse is attenuated by sound absorbers surrounding the discharge passage. Any noise generated in the header system or risers is caught and muffled by an absorbent lined chamber in each induction unit with similarly cushioned dampers.

• Water Supply:

The secondary water system consists of a shell-and-tube steam-to-water heater, pump, three-way water mixing valve, and distribution piping to all induction units. As the major exposures of the building are north and south, this system can be independently operated according to zone, the same as the air supply.

Supply and return risers for secondary water parallel the air risers. Water risers are sized for low friction loss and are direct return. Also, a reverse return or "first on, last off" header system assures that all parallel water circuits have essentially the same flow resistance, thereby prohibiting any one or group of risers from getting more water than others. Thus, the combination provides self-balancing characteristics without requiring balancing of water to each under-window unit.

No condensate drain piping system is needed for secondary or induction coils since all exterior zone dehumidification is done with primary air. The minimum secondary water temperature is high enough to prevent condensation.

• Controls:

Automatic temperature controls for the primary air system are grouped on one panel for ease in system operation and maintenance in the penthouse air conditioning plant.

The distinct separation of sensible and latent cooling functions, characteristic of the combination water and air system, provides some definite advantages. Most important of these is maximum dehumidification of primary air always available at lowest possible temperatures on the coil surface because of a full flow of water through the dehumidifier.

In summer, temperature of secondary water is kept constant by a modulating thermostat which positions a three-way valve that mixes water (usually 60 F) returning from the induction units with water from the coils of the primary air dehumidifier at about 50 F. Secondary water is supplied to the induction unit coils at about 55 F.

In winter this three-way valve is positioned to send all secondary water from the induction units through a water heater. Temperature is maintained by a thermostat which positions a steam valve on the water heater.

Humidification in winter is provided by preheating outside air to a sufficiently high temperature (45 to 55 F) so that moisture can be added when passed through the water sprays of the central conditioning apparatus.

During intermediate seasons when refrigeration equipment has been shut down, automatic controls on interior zone units make use of outside air cooling.

The existing 208 volt electrical system throughout the building was taxed to capacity with the modernization program. Motors on air conditioning duty total some 1800 hp. Rather than increase the size of the 208 volt service, it was more economical to install 440 volt transformers, taking advantage of smaller wiring possible with higher voltages. Therefore, a direct 440 volt installation was made from basement transformers to the new air conditioning equipment rooms on the 19th and 20th penthouse floors.

At the same time, all existing air handling units were converted to 440 volts so that air conditioning equipment could be metered separately. By measuring electric power demand and consumption, the building engineer is able to determine exactly how much it is costing for electric power to air condition the building.

Water and steam condensate are also metered. Operating costs from May through September 1957, the first full summer of operation (described by the Weather Bureau as a typical Atlanta summer) totaled only 9 cents a square foot for the entire operating season. The totals for the first summer of operation are based on an average running time of 11 hours daily, six days each week. The normal period is from 6 a. m. to 8 p. m. After Sunday shutdown the system is started again at 1 o'clock Monday morning.

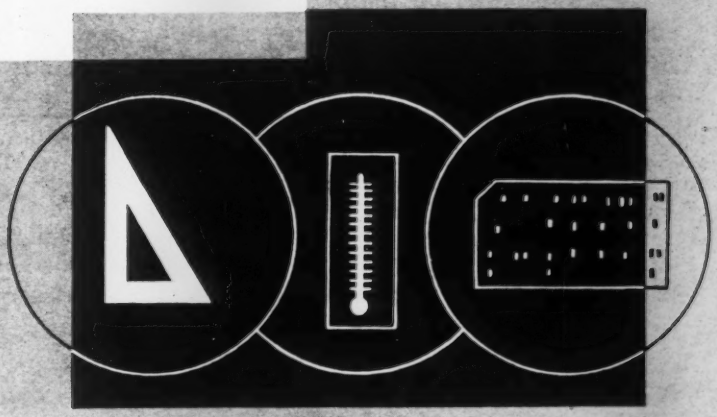
Jaros, Baum & Bolles of New York were the consulting engineers for this installation. ±

HPAC ENGINEERING DATA FILE

Air Force Conference Highlights Air Conditioning Operation and Maintenance

Program to minimize operation and maintenance costs should include:

- *Functional design*
- *Installation to ease maintenance*
- *Training of operators*
- *Scheduled preventive maintenance*



The Air Force recently held a conference for the engineering force that operates and maintains its vast mechanical cooling plant. The purpose — to interchange ideas with an eye to minimizing present and future operation and maintenance costs. While many topics covering design and installation were given attention in the program, emphasis was placed on making provisions now for maintaining the ever growing mechanical cooling complex needed for advanced weapons and for personnel efficiency.

The information presented in this report — from several conference papers — shows how they are attacking this problem. While much of this information is based upon Air Force experience, it applies equally to any air conditioning plant.

Operation and maintenance must be considered during every stage of system development. If neglected in design and installation, the penalty is high operation and maintenance costs. To assure satisfactory operation, those who will operate a system must have knowledge of the designer's concept of how the system is to perform. The designer is in a position to provide this information in operation and maintenance manuals and simplified operating instructions. These will help to maintain continuity of operation with minimum effects from operating personnel changes.

Continuous satisfactory performance of a system can be assured by initiating a preventive maintenance program tailored to meet the systems needs. A good program will include efficient scheduling of maintenance, collection of records, training of personnel in the necessary skills, and careful and thorough inspection procedures. Some ways to achieve these things are given in this report.

Stress Importance of Air Conditioning Operation and Maintenance at Air Force Conference

OPERATING AND MAINTAINING the air conditioning equipment of one of the largest single users of such equipment is a tremendous task. A part of the engineering force responsible for this met recently at a conference sponsored by the United States Air Force. These men and engineers from other government agencies and from industry met to discuss the many facets of mechanical cooling. The principal objective was to exchange ideas with others engaged in similar activities and, thereby, to improve the quality of Air Force mechanical cooling installations.

The conference program included a broad range of topics — from evaporative cooling, to the selection of refrigerants for a particular service, to a discussion of the tools required for effective preventive maintenance. The speakers from the Air Force, other government agencies, and industry presented much information of interest to those assembled. Design, installation, maintenance, and operation of air conditioning plants were all discussed. The underlying theme, however, was the importance of planning now to prevent excessive maintenance and operation costs in the future. A number of papers were presented on this subject and some of the highlights are reported here to show how the Air Force is attacking this important problem.

While many of the papers presented at the conference reflect Air Force experience, they are pertinent to operation and maintenance of air conditioning systems in any application. The magnitude of the Air Force mechanical cooling plant serves to emphasize the importance of principles that can and should be applied to systems of lesser size and complexity but of equal importance. A sound program to minimize the long term costs of air conditioning—operation and maintenance costs—should include:

1) An awareness of the penalty that can be imposed by neglecting to consider operation and maintenance at every stage in the design and installation of a system.

2) Proper training of operators so that the design intent is preserved and the system is operated in an economic fashion. Responsibility for this rests with the designer as well as with the supervisory operating engineer.

3) Proper periodic preventive maintenance to assure that the system will continue to perform satisfactorily and have a long life expectancy. Records, trained personnel, and good inspection procedures combine to form an efficient preventive maintenance program.

These aspects of such a program are considered in more detail in this report.

Maintenance Will Become More Important

Major General A. M. Minton, director of civil engineering, United States Air Force, discussed the problems facing the Air Force in maintaining their existing facilities and those which will be put into operation in the future. In his remarks he said:

"There are two or three points that I would like to see this conference concentrate on. First, is our problem of maintenance. I think that, in the next two or three years, maintenance will be our largest single headache. We are now building up an inventory of facilities (of all types) that has to be maintained at a rate of more than a billion dollars a year. With budget and manpower restrictions, the capability that we have to maintain that equipment isn't being built up in the same proportion.

"I often use the illustration that we're living in a fool's paradise now. It's fairly easy to maintain air conditioning equipment, Capehart houses, and all the very complicated equipment that we're installing during the first two or three years. It's new equipment and doesn't wear out that fast. I think that if we do not make, at this time, reasonable provisions for the maintenance of this equipment, air conditioning among others, that in three or four years we will have a problem that will be most difficult to resolve. I think in all of your deliberations as far as the Air Force is concerned, that perhaps the first consideration you should keep in the back of your mind is the Air Force problem of maintenance."

Basic Air Force-Industry Differences

"There are some conditions that Air Force has that are somewhat different from the normal industry problems. First, as all of you know, some of our most complicated installations of air conditioning are at remote sites. Strangely enough, some of our most complicated installations are in the Far North where you'd think little air conditioning was needed. We need it, just the same, because of the operational requirements there. Generally, it's far away from good service. If some complicated piece of equipment in industry doesn't operate properly, you can get quick service, as well as the parts, but we can't do that where we are. So, we must have a little more reliability in our equipment and in our design for this equipment than is normally considered necessary. As a rule, we have some 50 to 75 million dollars worth of equipment, and in some of our installations far more than that, actually depending upon this little 50 to 100 thousand dollar piece of air conditioning equipment. If it doesn't operate, then the millions of dollars worth of computers and other technical equipment do not operate," General Minton noted.

"Another point that you should keep in the back of your mind in our equipment requirement is the very exact environmental control that we must have. As a general rule, the biggest problem with the new complicated pieces of equipment that we try to air condition is the failure to meet the requirements as far as very close tolerances of humidity, temperature, volume of air, etc., are concerned.

"There's one other problem that we've run into. We make every effort to buy good and well-tested equipment. As a general rule, it's fine until we assemble eight or ten components, and then try to make them work together. Too often, when we put them all together, they just don't work as well as they should.

"To a great extent, I think perhaps that is due to the failure on the part of our architects and engineers to properly appreciate the problem and perhaps to have the proper training and background to do the job. I'm not at all sure that, sometime in the future, this organization shouldn't have some means of—for a lack of a better term—licensing our architects and engineers to be certain that these very complicated installations are properly designed.

"That leads up to the next point which I think will solve part of these problems. I want to go on record as wholeheartedly, in behalf of the Air Force, supporting the program of the Air-Conditioning & Refrigeration Institute for the certification of the equipment that we're getting. I'd like to go a step further and urge that you expedite this program. We need it and we need it badly. I would like to see you enlarge it somewhat as soon as you can to consider larger units, the heat pump, and related equipment.

"I plan that, within a reasonable period of time, after we're certain that the certification program is adequate, that the Air Force will require in our invitations for bid ARI certification before we'll accept the equipment."

General Minton concluded his remarks by urging that some kind of a test method be developed to determine reliability, life, and quality of air conditioning equipment. This would be in addition to a one-time performance standard.

People Are Important, Too

While presenting the objectives of the conference, William T. Smith, chief of the air conditioning and refrigeration section, Headquarters, United States Air Force, stressed the importance of the people who operate and maintain the air conditioning equipment. "An organization is not just a lot of machines, tools, and red tape—it's people like you and me—and if they are capable, intelligent and well-fitted for their respective positions, you will have a smooth, efficient organization and this success will be reflected in better performance at minimum cost," he said. "Conversely, if those in responsible positions are not thoroughly acquainted with the problems involved in proper installation, operation, and maintenance, there is every reason to expect unsatisfactory service from the equipment and costs will skyrocket.

"This is especially true in the field of mechanical cooling. The equipment used in connection with many of these systems is delicate and of a highly technical nature. Plant failures frequently result in a serious loss of stored materials, lowered morale, unnecessary expenditures, and even task force failures. It is essential, therefore, that all personnel concerned with this equipment be thoroughly aware of the purpose of the plant and be intimately familiar with its technical features.

"Mechanical cooling has developed into an important phase of Air Force functioning. Ten years ago the Air Force could boast of only 35 to 40 million dollars of mechanical cooling equipment. By 1952, we had built this investment to over 100 million dollars and by 1958 we had reached the 400 million dollar mark. By 1960, if we continue our present rate of expansion, we will have cracked through the 500 million dollar barrier and will be headed at a tremendous pace toward the three quarter billion dollar mark!

"What about our maintenance cost? Starting with something less than 3 million dollars per year, in 1950, we had built up to approximately 8½ million by 1956, and the present rate indicates a maintenance bill in excess of 10 million dollars for fiscal 1960."

Mr. Smith concluded his remarks by emphasizing again the need for efficient control of the rapidly expanding mechanical cooling program.

Operation and Maintenance Manuals

The increasing complexity of air conditioning suggests the need for operation and maintenance manuals and these should be a design responsibility, stated W. Norman Meyer, chief, mechanical branch, Air Force Academy Construction Agency.

"The application of air conditioning has now become so extensive and so diversified that we can no longer meet requirements with simple systems nor can we leave procedure to the discretion of the operators," he said. "Instead, the time has come when the operating procedures must be designed into the system. This is by no means a new thought. Detailed operation and maintenance instructions are standard for all flight line equipment. The tremendous and complicated chemical and petroleum industries even go to the extent of building scale models of their plants. Production engineers are then brought in to write operating instructions before the final design is completed and before construction is started. To get the full benefit from the money we spend for extensive air conditioning, it is time that we paid more attention to the methods of operation."

Must Expect Personnel Changes

"Neither the Air Force nor private industry is able to pay high enough operator's wages to insure acceptable operation of complicated systems without supplemental technical guidance. With present wages, frequent changes in operating personnel

"To get full benefit from the money we spend for extensive air conditioning, it is time that we paid more attention to the methods of operation. The most effective operating instructions are those posted in the immediate vicinity of the equipment."

POSTED OPERATING INSTRUCTIONS similar to those shown here were prepared for each system in the Air Force Academy air conditioning complex. Simplified equipment and control diagrams of this type are provided operators to assure intelligent operation. These are one part of the concept of providing operating instructions and maintenance manuals established for the Academy

must be anticipated. Such changes invariably result in deviations in operating procedures unless adequate guides are provided," Mr. Meyer continued.

"Past practices have been to hold the contractor and the equipment manufacturer responsible for the furnishing of operation and maintenance manuals and for the training of our operators. They are not normally qualified nor staffed to prepare operating instructions, especially for systems designed by someone else. Any requirements in the contract for instructions are therefore passed on to the most convenient subcontractor or supplier. Suppliers are primarily interested in the equipment they furnish and generally not in the system as a whole. The usual assembly of maintenance manuals from various suppliers and manufacturers is generally so massive that it is seldom used by the operator. The most effective instructions are those that are posted in the immediate vicinity of the equipment," he said.

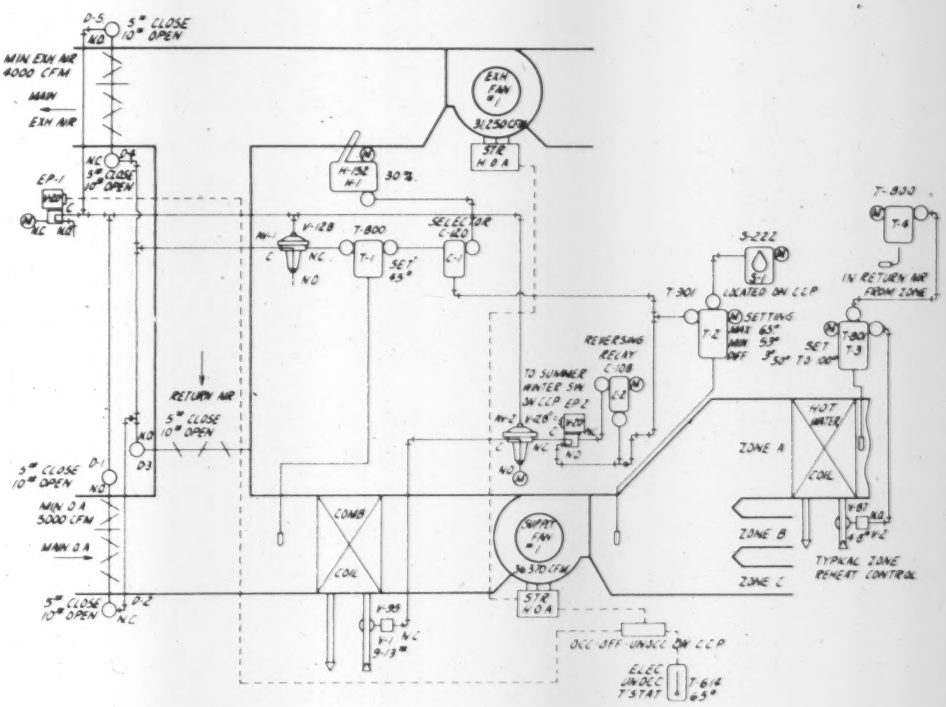
Design Intent Not Always Clear

"Frequently, in the construction of a major facility, neither the contractor nor the manufacturer is able to determine from the plans and specifications exactly what type of operation is intended in the design," stated Mr. Meyer. "Plans and specifications do not always indicate required coordination between trades. We are all aware of the various trades involved in the construction of large air conditioning systems.

"Plans and specifications recognize that the contractor deals with numerous trades. In our profession we also have considerable division of responsibility. The architects and engineers have virtually completed their job when the plans and specifications are sent out for bids. They are never called in again unless there is an obvious error or unless something does not perform satisfactorily. Next, the contracting officer takes over with the assistance of a construction engineer or inspector. Even if the construction engineer knows considerable about mechanical systems, he is not supposed to redesign the system but is to make sure that it is built in accordance with the plans and specifications. After the construction is completed, the facility is turned over to the operators of the using agency. The operator then has the responsibility of producing a satisfactory end result with the equipment as installed.

"For minor construction projects many of you may be able to follow the mechanical installations throughout construction. However, most of our large facilities are being provided under the major construction program where the construction is supervised in its entirety by some other agency. This being the case, the using agency when requesting a facility should require the designer to provide not only the plans and specifications necessary for construction, but also adequate guides and instructions for its proper operation and maintenance.

"For the Air Force Academy, it was recognized during the preliminary stages of design, that complicated systems would be required to produce satisfactory conditions in the occupied space. The architect's concept incorporated the extensive use of glass and aluminum. Recommendations to ob-



Theater System S-1

Zone	Area	T-4 Setting
B-1A	Under Balcony Supply & Return	72 F
B-1B	Upper Balcony Supply & Return	75 F
B-1C	Main Area Supply & Side Return	73 F
T-614	Under Balcony Space (unocc.)	65 F

OPERATING INSTRUCTIONS

1) General

a) Keep all fan motor starters in "Auto" position. "Hand" and "Off" positions are for maintenance only.

b) Check to make sure that E-8 starts when S-8 starts.

c) Set minimum fresh air damper and minimum exhaust air damper to indicated cfm of air for normal occupancy. For heavy occupancy, increase ventilation through Main OA dampers by adjusting temperature controller S-222 on the central control panel. To conserve heat, set T-2 at 65 F during the winter and reset to 54 F during scheduled heavy occupancy from April to November.

2) Selector Switch on Central Control Panel in "Occupied" Position

a) S-8 and E-8 run continuously.

b) EP-1 is energized. Check to see that minimum OA and minimum EA dampers are open and that control air is supplied to AV-1 and AV-2.

c) Seasonal Switch on Central Control Panel in "Winter" Position.

(1) EP-2 is energized placing V-1 under control of T-2 through reversing relay C-2. Check to see that V-1 opens when discharge temperature is below T-2 setting and closes when T-2 is satisfied.

(2) When discharge temperature is above setting of T-2, check to see that T-2 modulates Main OA, RA and EA dampers to provide increased ventilation to maintain setting of T-2.

(3) Set H-1 to increase opening of OA dampers when necessary to maintain a maximum of 30% humidity in the return air.

(4) Periodically check setting of T-1 to make sure that it shuts down OA dampers completely when the mixed air temperature drops below 45 F irrespective of the requirements of T-2.

d) Seasonal Switch on Central Control Panel in "Summer" Position.

(1) EP-2 is deenergized, deactivating reversing relay C-2 permitting V-1 to be direct acting from T-2.

(2) Below setting of T-2, Main OA damper and V-1 are closed. On an increase in discharge air temperature, the Main OA damper modulates to the open position permitting chilled EG to circulate through the combination coil for further cooling.

(3) On an increase in humidity in the space, H-1 increases the extent of Main OA damper opening irrespective of T-2 to reduce the humidity to the set point by increased ventilation.

3) Occupancy Switch in "Unoccupied" Position.

a) Fans start and system operates when the temperature is below the setting of T-614. EP-1 is not energized keeping all OA dampers closed and V-1 fully open.

b) When the temperature is above the setting of T-614, the fans are stopped and AV-2 maintains full heat to the combination coil.

4) Operation of Reheat Coils

a) Operation of reheat coils is under constant control of zone thermostats irrespective of supply and exhaust fan operation. Submaster thermostat T-3 will, however, limit the temperature rise at the reheat coil to prevent overheating in the duct.

b) Set zone thermostat T-4 as indicated to modulate V-2 to supply the amount of reheat required during occupied hours.

c) When the system is operating during unoccupied cycle, zone thermostat T-4 will call for full heat through V-2, subject to the limitations of T-3, reducing the length of fan operating time required to satisfy T-614.

tain overhangs, shading devices or more favorable orientation were not incorporated. The size and usage of the buildings is such that many areas are of necessity without natural light or ventilation. Year 'round conditioning of the interior spaces therefore became essential. Fortunately, extensive mechanical refrigeration was not required because of the availability of cool, dry mountain air. Conditioning of many spaces has quite generally been accomplished by supplying more outside air when cooling or dehumidification is needed. Since it was known that the required systems would be complicated, it was decided to handle the operator's problems by preparing comprehensive operating instructions and by installing graphic central control panels in the larger buildings. This would not only provide central control for economy of operation but it appeared to be the only way to assure intelligent operation," Mr. Meyer said.

Preparation of O & M Manual

"During the past several months, the Air Force Academy Construction Agency has been preparing the final operation and maintenance manuals for the Academy," Mr. Meyer reported.

The operation and maintenance manuals contain a description of the design considerations, operating instructions, and maintenance instructions for each mechanical system. For example, the information included in the manual for a typical building for the heating and ventilating systems is as follows:

1) Design concept.
2) Operating instructions which include:
   a) Word description of the system.
   b) Equipment, flow and control diagrams with operating sequence and conditions.
   c) Valve schedule.
3) Maintenance instructions.
   a) References to AF manuals and regulations.
   b) Manufacturer's maintenance instructions.
   c) Parts list and recommended stock levels.
   d) Tabulation of catalog data, specification sheets, etc.

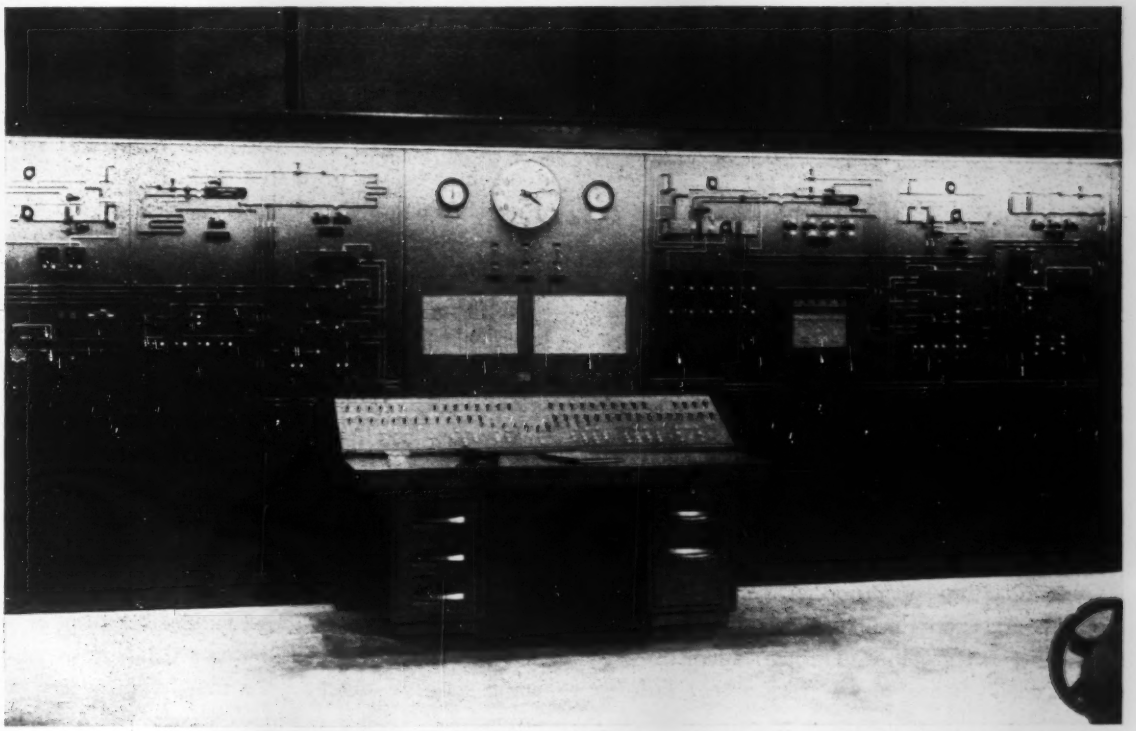
"Even though we fully recall the design intent," said Mr. Meyer, "we find it necessary to go back to the design analysis and sometimes recalculate a given set of conditions. We must again review the type and hours of occupancy, the amount of minimum and maximum ventilation requirements, and the exact settings of submaster temperature controls."

Posted Operating Instructions

"When the desires of the Air Force regarding preparation of operating instructions became fully known, the representatives of all the major control manufacturers were most cooperative. They recognized that the posted instructions would not only be helpful to the regular operating personnel, but that they would assure creditable performance of their equipment and that they would be a definite aid to their own servicemen. An example of the posted operating instructions is shown on page 137. This is a copy of the posted instructions for one of the air handling systems in the 3000 man theater in the Cadet Social Center. Acceptance tests were made under full occupancy during the graduating exercises in June and performance was most gratifying.

"Irrespective of the simplicity or the complexity of the system, the diagrams and written instructions for the theater are typical for all systems. The same concept of providing the operators with simplified, consolidated equipment and control diagrams has been extended to the central control panels provided in each of the major buildings. It was originally intended that all major Academic Area heating and air conditioning systems would be controlled from one central point. The economic feasibility of such an installation was questioned and separate centers were provided in three buildings. A simple pushbutton control center was also provided in the Cadet Quarters Building. When the size and scope of the buildings are visualized, the need for central control panels of the graphic type can readily be appreciated.

"The above information portrays one concept of maintenance manuals and posted operating instructions. Fortunately, it was not necessary that operating instructions be prepared in any exact manner. Our form of presentation has changed and we think improved for the more recent buildings. However, in discussing effectiveness with operators, we find that they consider all of the instructions much better than anything they have ever received before. Now they object to accepting



GRAPHIC CENTRAL CONTROL panels such as one shown here serving the Superintendent, Staff, and Administration Building, and the Social Center of the Air Force Academy, are similar in concept to simplified posted operating instructions. Central control panels, in addition to providing economy of operation, help to assure intelligent operation

a facility unless operating instructions are provided in advance. The thought no doubt occurs to you that the posted instructions are fine but how should Air Force engineers proceed with getting them for their installations," he asked.

What Instructions Should Include

"In preparing this paper, the problem of how to handle future Air Force projects has been brought into sharper focus. At the time the Air Force Academy was started, Air Force Manual 88-8 had not been published. This manual requires that 'The sequence of operation of the automatic controls should be clearly and completely described in the specifications.' Now we can insist that the designers comply with the requirements of the manual insofar as incorporating the control diagrams and sequence of operation in the design. To insure proper operation the following points should be observed:

"1) The designer should be required to include a diagram of the basic equipment and all electrical interlocks as well as the basic control equipment.

"2) Tolerances on the control of temperature and humidity and quantity of air for ventilation and water for cooling and heating should be indicated. These represent basic design concepts and can therefore be most advantageously included for review and approval in the preliminary design submittal.

"3) Prior to installation, the contractor should be required by specifications to include with his material submittal specific control points and pressure settings of the various component parts of the system he proposes to furnish.

"4) Upon approving the materials and controls, the designer should be required to complete the operating instructions and return prints for posting along with the material approval to the contractor. Unknown items such as hours of occupancy may be left blank for subsequent insertion by the using agency.

"5) No unauthorized deviations in the operating instructions should be permitted by operation or maintenance personnel. Their recommendations and suggestions for changes should be invited but before being incorporated they should be submitted to the Base Engineer for ap-

proval. In this manner deviations will be reviewed by technically qualified personnel. Our engineers will thereby have a better chance to preserve the design intent and yet correct any operating difficulties that are certain to be encountered in any new design.

"It is recognized that this program is not an easy one to place in effect. Architect-Engineering firms are not fully aware of the problem nor are they accustomed to including operating instructions in their design service. Secondly, many of our engineering supervisors are not fully aware of the difficulties encountered in placing a new mechanical system in operation. There is a general feeling that air conditioning and other forms of mechanical systems are 'cut and dried' and if they are properly designed they ought to operate when you press a button. All of you know that this is far from the fact and that most mechanical systems must be put through a shake-down cycle before satisfaction can be assured. Each of you has observed examples of poor performance from well designed systems. If you feel as I do that better results can be obtained with suitable operating instructions, you will insist on their being included in the design, and in their being provided for the training of operators before taking over a new installation," Mr. Meyer concluded.

Preventive Maintenance — Scheduling, Procedures

Once put into operation, a system must be properly and periodically maintained to insure satisfactory performance. Through adequate preventive maintenance procedures, system failures and system deterioration can be anticipated and corrected. A reliable maintenance program requires efficient programming of the following things said L. G. King, director of service education, Worthington Corp:

1) Inspection records and check lists.

2) Properly trained and tooled personnel.

3) Inspection and test procedures pertaining to trouble shooting.

4) Emergency stock of essential replacement parts.

Schedule Maintenance Mechanically

An important part of any preventive maintenance program is the recording of pertinent facts necessary to efficient scheduling of inspections and repairs. Numerous methods of record keeping can be used, including programs employing electronic data processing equipment (EDPE) when it is available.

A program for mechanically scheduling periodic preventive maintenance by taking advantage of the capabilities of simple EDPE was outlined by Captain H. G. Snider, instructor, department of advanced engineering, Institute of Technology, Air University, USAF. A program of this type is in operation at Wright Patterson AFB, Ohio and refinements are being made on the basis of operating experience. The objective of this program—as in all preventive maintenance programs—is to provide a schedule that will assure a constant state of maintenance thereby providing a responsible service to the customers' needs.

The advantages of mechanized scheduling and recording of data according to Captain Snider are:

1) A constant work load is automatically established for maintenance personnel.

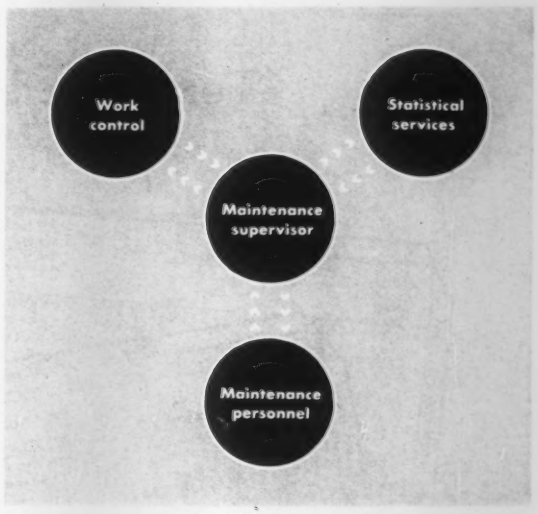
2) A maximum maintenance force is provided by reducing the administrative work load of supervisory personnel.

3) A high quality of maintenance is assured with respect to man-hours expended.

4) A current equipment inventory is established and maintained.

5) Accurate maintenance records are maintained that can readily be used in future economic analyses of maintenance costs.

In this method of scheduling maintenance, information flows from a statistical services unit through the maintenance supervisor to the maintenance personnel and back. Inspections are initiated when master data cards are scanned by EDPE and work cards prepared by statistical services. This is done on a predetermined time schedule so that the maintenance supervisor is informed in advance of inspections required in any given week. Data arising from inspection is sent to statistical services for recording for future cost and manpower analyses. Work control is called upon when ex-



FLOW OF INFORMATION between individuals in mechanically scheduled preventive maintenance program is illustrated here in simple form. Supervisory maintenance personnel are center of program, but statistical services assumes burden of record keeping. Inspection is initiated when master cards are scanned by statistical services. Work card is sent to supervisor who turns it over to maintenance personnel. When inspection is completed, work card is returned to statistical services and new data recorded. Work control is called on when extensive repairs and parts are required. Materials costs are recorded for future analyses.

tensive repairs and parts are required. Pertinent purchasing and work order data are recorded for scheduling and also for future cost analyses.

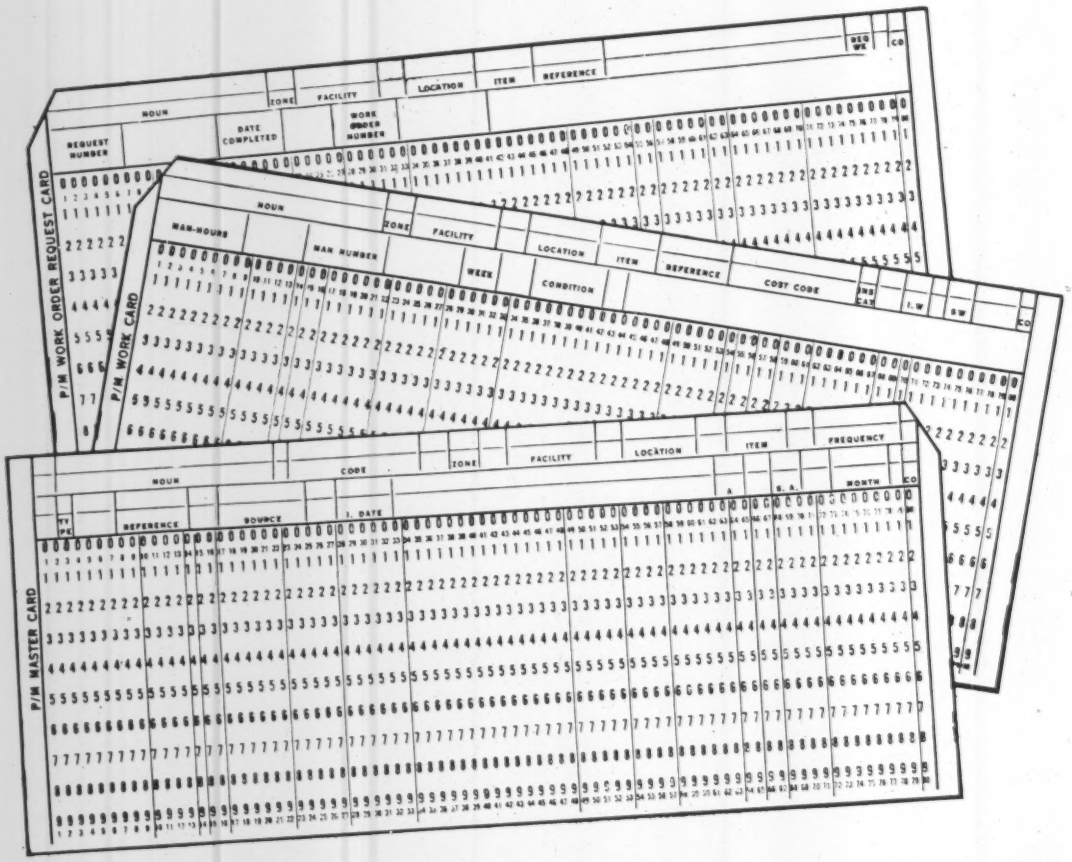
Three data processing cards and several other forms are used in the program outlined by Captain Snider. The first EDPE form is a master card on which is stored basic inventory information and the schedule of periodic inspections for the equipment. One such card is prepared for each equipment item included in the program. The information recorded on the card includes, equipment type, location, use, installation date, capacity, manufacturer and the weeks of the year on which inspections are to be made. The service schedule is set up to provide a uniform work load for the maintenance force taking into account the approximate times established for each inspection at the beginning of the program, seasonal requirements, physical location, and travel time. Periodic inspections of increasing thoroughness are made monthly, semi-annually, and annually.

The second card—the work card—is prepared from the master card in accordance with the schedule frequency number by the statistical services unit prior to the time that a service inspection is required for a given piece of equipment. On this card is recorded by EDPE, information needed by the maintenance force. This includes equipment type, location, type of inspection to be made, and the week in which the inspection is to be made. These are distributed by the maintenance supervisor with a check list of items to be inspected and returned to him when the inspection has been completed. At the time of inspection, the mechanic records the number of hours spent on the inspection, his coded number for future reference in the event of failure, the week in which he has completed the work, and the general condition of the equipment. Thus, the amount of information that he must record is minimized. The completed work cards are then returned to statistical services and the information placed on the cards in coded form for easy recall in future analyses of maintenance procedures.

In the event that the mechanic finds that more extensive repairs are needed than can be taken care of during routine inspection, he submits a description of the work required—including the parts needed—to the maintenance supervisor. This information is supplied to the statistical service section where the third EDPE card — the work order request card — is prepared. This card is forewarded to the work control section where the necessary steps are taken to prepare the work orders, procure materials and perform the required work.

The maintenance supervisor is the center of the program and much of his time is saved through mechanized scheduling, as pointed out by Captain Snider. The burden of record keeping is shifted from the maintenance personnel to the statistical services unit. Adjustments in work load can be made as experience is gained and records are analyzed. Through the use of EDPE such anal-

Forms used for Mechanized Scheduling



THE MEMORY of electronic data processing systems — the punch cards shown above — can be used to schedule periodic preventive maintenance. From top to bottom cards are master, work, and work order request cards, respectively. Information stored on cards can be recalled as reminder that inspections are due and can be used to easily determine maintenance costs

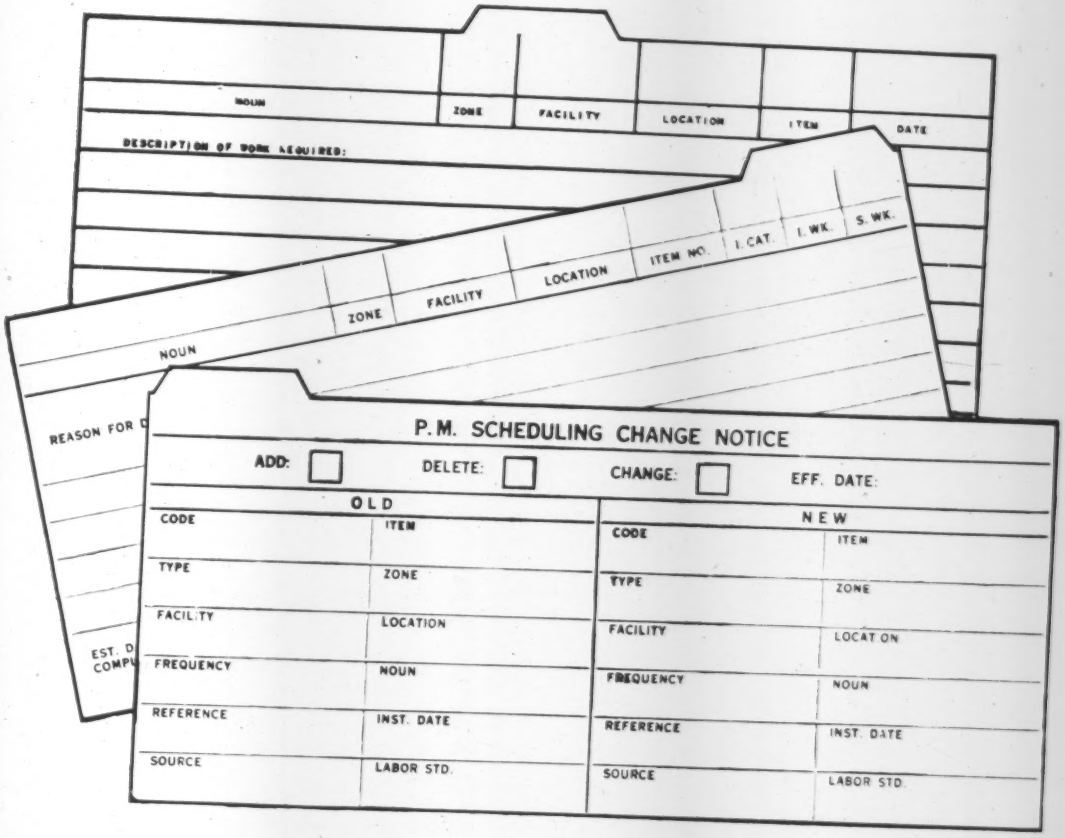
yses and others pertaining to the economics of maintaining a particular facility can be quickly made.

Personnel Training Essential

"In order to properly and effectively carry out a program of preventive maintenance one must first provide, or secure, the proper training of all departmental personnel including 'top management' of this section," Mr. King said. Maintenance personnel should be thoroughly informed of the pertinent data relative to design, construction, and all general physical aspects of the apparatus he is to maintain. This training should be continuous, and the men should be encouraged to gain all the information they can concerning proven and new techniques of solving problems that may arise. They should be thorough in their observations of operating conditions and should apply corrective measures at once when signs of trouble appear, he said.

W. A. Harriman, principal instructor, department of utilities training, Sheppard Technical Training Center, described several Air Force training programs for personnel with no prior

# of Periodic Preventive Maintenance



FORMS shown here are used by maintenance personnel to supply information to statistical services that falls outside of scheduled program. Such things as unusual maintenance revealed during routine inspection, change in inventory information, and delinquent inspections are taken care of in this way. One advantage of mechanized program is reduction of administrative work load of supervisory personnel

experience in the operation and maintenance of air conditioning and refrigeration equipment. The course given basic airmen consists of 510 hours of combined theoretical and practical training. About 75 percent of the student's time is devoted to practical training with equipment that he will be expected to maintain and may be likened to on-the-job training. A parallel course with more extensive training on specialized equipment is given to those who will operate and maintain the complex installations required to cool the equipment for SAGE and other advanced weapons systems.

List Inspection Procedures

Preventive maintenance inspections of air conditioning systems should start at the condensing unit—the heart of the system, Mr. King said. Most system defects are reflected back to the compressor and costly repairs can be avoided if corrective measures are applied when an unsatisfactory condition is noted. The inspection of a condensing unit, he said, should include the following:

1) Operating discharge and suction pressures.

2) Operating discharge and suction temperatures.

Air Force Training Program for Air Conditioning and Refrigeration Specialist

This course is given basic airmen to prepare them for operation and maintenance duties. Approximately 75 percent of the student's time is spent on practical exercises on the equipment that he will maintain.

Fundamentals (60 hrs)
- Hand and special tools
- Hardware
- Fittings
- Tubing and pipe fabrication
- Welding and soldering

Electricity and Principles of Refrigeration (120 hrs)
- Fundamentals of electricity
- Technical orders
- Product Improvement
- Blueprint reading
- Physical and chemical principles of refrigeration
- Refrigeration principles and components

Single and Complex Refrigeration Systems (120 hrs)
- Simple refrigeration systems
- Inspection
- Maintenance and trouble analysis of compressors, condensers, evaporators, and receivers
- Principles and adjustment of thermal and pressure control units
- Maintenance, inspection and trouble analysis of refrigeration accessories

Multiple Refrigeration Systems, Water Analysis (90 hrs)
- Operation and trouble analysis of multiple refrigeration systems
- Internal combustion engine powered condensers
- Centrifugal pumps
- Steam heat
- Water analysis

Commercial Refrigeration, Air Conditioning (120 hrs)
- Problems related to refrigeration systems
- Operation, adjustment, repair and trouble analysis of domestic and commercial refrigeration
- Air conditioning problems
- Operation, adjustment and trouble analysis of air conditioning systems

3) Overall suction superheat at the compressor.

4) Oil level in the crankcase.

5) Condition of the oil in the crankcase (whether dirty or foamy).

6) Operating effective oil pressure of all compressors having forced feed lubrication.

7) Operating surface temperatures of the compressor, including crankcase, seal housing, and cylinder surface temperatures.

8) Condition and tension of the belts.

9) Condition (both physical and mechanical) of the compressor and motor sheaves.

When deviations from normal conditions are noted during an inspection, the source of the deviation should be determined and corrective measures taken. The corrective measures should follow along the lines of good common sense, proven standard practices, and in accord with the manufacturer's recommendations, he said.

Motors are generally taken for granted and, as a result, receive very little attention, Mr. King noted. They are next to the condensing unit in importance and should be the next component to be carefully checked out. System troubles are reflected in excessive current draw that, in time, breaks down the insulation on the windings resulting in an eventual system breakdown due to motor failure, he said. Motors should be checked for:

1) Bearing temperature.

2) Current draw at the motor terminals.

3) Proper lubrication.

Along with the motor, he said, the control system should be checked thoroughly for:

1) Proper setting.

2) Proper operation.

3) Frayed or broken wires and system grounds.

The impulses of the controls—the nerve system—produce the end results that the system was designed to produce, he noted. If they are not operating in proper coordination and sequence, serious damage to the operating components can be the eventual result.

Operate Safety Controls Periodically

The safety controls are next in line in a good preventive maintenance inspection, Mr. King said. These controls were designed for "safety" reasons. They were not meant to be used as operational controls, he pointed out. For this rea-

son, it is very important that they be made to operate periodically, producing the abnormal conditions manually that they are set to protect against. If the settings have drifted from their original values due to aging of the springs or vibrations of the condensing unit, they should be reset to the recommended settings, he said. These safety controls indicate trouble whenever they shutdown the system. The control setting should never be changed to put the system back on the line unless the control has drifted, he said. The reason for shutdown should be carefully checked out and the trouble corrected at once to prevent serious damage and the possibility of injury to nearby personnel. These safety controls include the high and low pressure controls, the oil failure switch on forced feed lubricated compressors, and crankcase heater thermostats, he said. In checking the safety controls then, the following should be checked:

1) Proper setting.
2) Proper operation.

Don't Neglect Heat Exchangers

Next in line, and often the source of trouble, are the heat exchange components of the system, Mr. King continued. These are the evaporators and the condensers. It is important, he said, that the coil surfaces are kept clean and free of all dirt, soot, lint, and scale. Dirty cooling coil surfaces cause suction pressures to fluctuate drastically, resulting in:

1) Excessively high suction superheat.
2) Expansion valve "hunting", and eventual periodic liquid or oil slugging.

Dirty condenser coil surfaces, he noted, cause excessively high discharge pressures and temperatures resulting in:

1) Carbonizing of lubricating oils and formation of sludges.
2) Wire drawing of valve reeds and the seats of valve plates.
3) Wire drawing of valve needles and seats.
4) Excessive wear on cylinders, pistons, and rings due to extreme thinning of the lubricating oil.
5) Broken crankshafts in extreme cases.

In line with the low side heat transfer equipment, the refrigerant flow controls should be checked periodically, Mr. King stated. These too wear—it is a slow process that is speeded up by dirt, sludge, and oxides that may be circulated in the refrigerant stream, he cautioned. The oxides resulting from brazing during installation are particularly hard on the valve seats, he said. Whenever the seats become eroded through use or because of contaminants in the system the result is:

1) Liquid flood back.
2) Very low superheat or none at all.
3) Excessive valve "hunting".

The superheat at the compressor, as well as that at the evaporator, should be checked periodically, he said. When suction lines are long, it is conceivable that the superheat at the compressor may exceed that for which it was designed even though the superheat at the evaporator is correct. This reduces operating efficiency and may lead to failure of the compressor, he noted. To check the superheat he suggested the following procedures:

At the evaporator

1) Insert pressure gage in expansion valve equalizer line. Convert pressure to saturated refrigerant temperature.
2) Read temperature of tubing surface at outlet of cooling coil with a thermocouple or thermometer. Good contact must be obtained between tube and sensing element, and the temperature measuring device should be shielded from the environment.
3) The difference between (1) and (2) provides the superheat at the evaporator. This should be compared with the design value.

At the compressor

1) Read the suction pressure and convert to saturated refrigerant temperature.
2) Read the surface temperature of the suction line. Select a location a short distance from the compressor to minimize radiation effects and on the side of the suction line to obtain a reasonable indication of the gas temperature.
3) The difference between the temperatures obtained is the superheat at the compressor.

In some cases, Mr. King noted that a compromise setting of the expansion valve may be necessary to maintain the superheat within reasonable limits of the rated values for the cooling coil and the compressor.

Many failures of equipment have resulted from neglect of the heat exchange components, he cautioned. The usual end result of this neglect is a compressor failure. It is the only moving part within the system and as was noted above, any system discrepancies are readily reflected back to the compressor. The compressor suffers severly from these unless they are observed in the preventive maintenance inspections and corrected, he said.

Where These Concepts Apply

As mentioned at the beginning of this report, the problems facing the Air Force are the same — even though of greater dollar and cents magnitude — as those occurring in numerous smaller installations. Consideration must be given to operating and maintaining the increasingly more complex systems required to satisfy the higher level of environmental control now demanded in process and personnel air conditioning. Beginning with the inception of the system, attention should be given to operation and maintenance. Careful selection of components, location and space for ease of maintenance, and design innovations based upon future maintenance needs can substantially reduce maintenance costs.

Satisfactory operation can be assured by providing operating personnel with pertinent design concepts and training them in the application of them. Many of the necessary operating instructions are embodied in the plans and specifications but not always in a form that is easily applied. Operation and maintenance manuals and posted operating instructions prepared in design will help to provide continuity of operation regardless of personnel changes while retaining the economic operation and environmental control included in the design.

Preventive maintenance to assure that all components of the system perform to the maximum of their ability without failure is a must. Anticipation of system deterioration — which must occur to some extent with age — will provide the lowest possible maintenance expense. Whether scheduling and record keeping is accomplished by EDPE equipment or by other successful methods is relatively unimportant. However, when such time saving equipment is available, it can contribute much to the efficient conduct of the preventive maintenance program.

The importance of trained personnel in an efficient operation and preventive maintenance program cannot be over emphasized. O and M manuals are valuable assets to operating personnel but are no substitute for trained and competent operators.Where the need justifys on-the-job training of personnel, a program similar to that conducted by the Air Force might be considered. The skills required for maintaining a particular system may suggest varying the content of the training program to meet these needs.

Careful inspection of the system components subject to deterioration at scheduled intervals is the heart of the preventive maintenance program. Knowledge of the equipment and its weaknesses, if any, will provide the necessary check lists to be followed in the maintenance inspection. Thorough checking of these points will assure uninterrupted and satisfactory performance.

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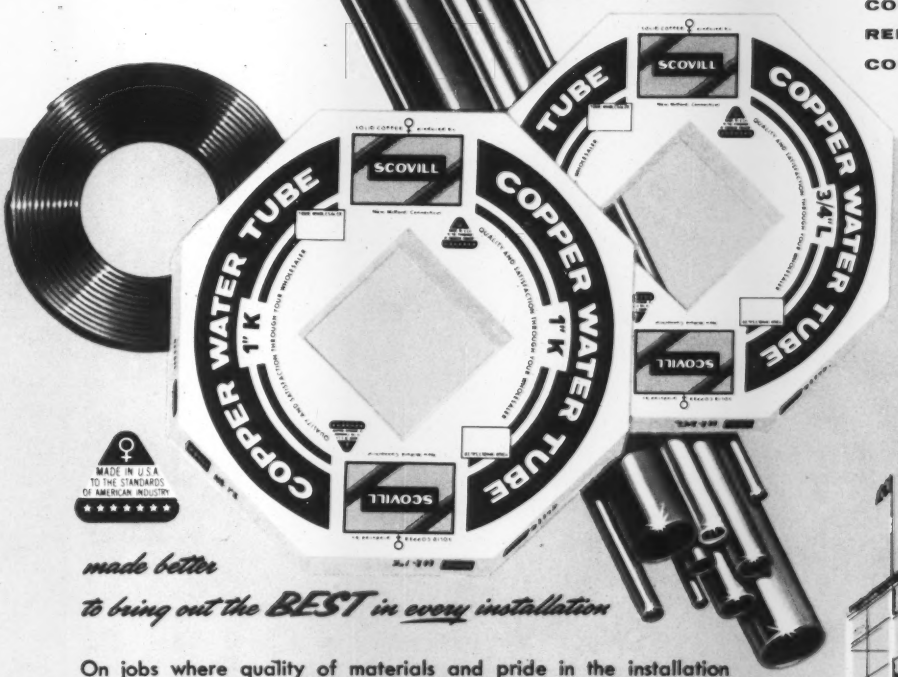

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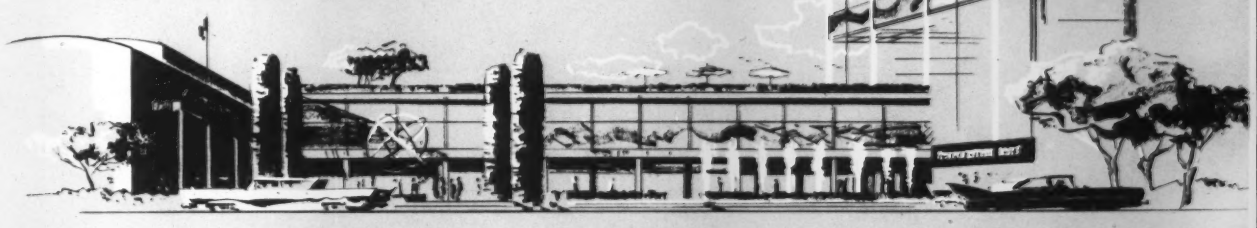

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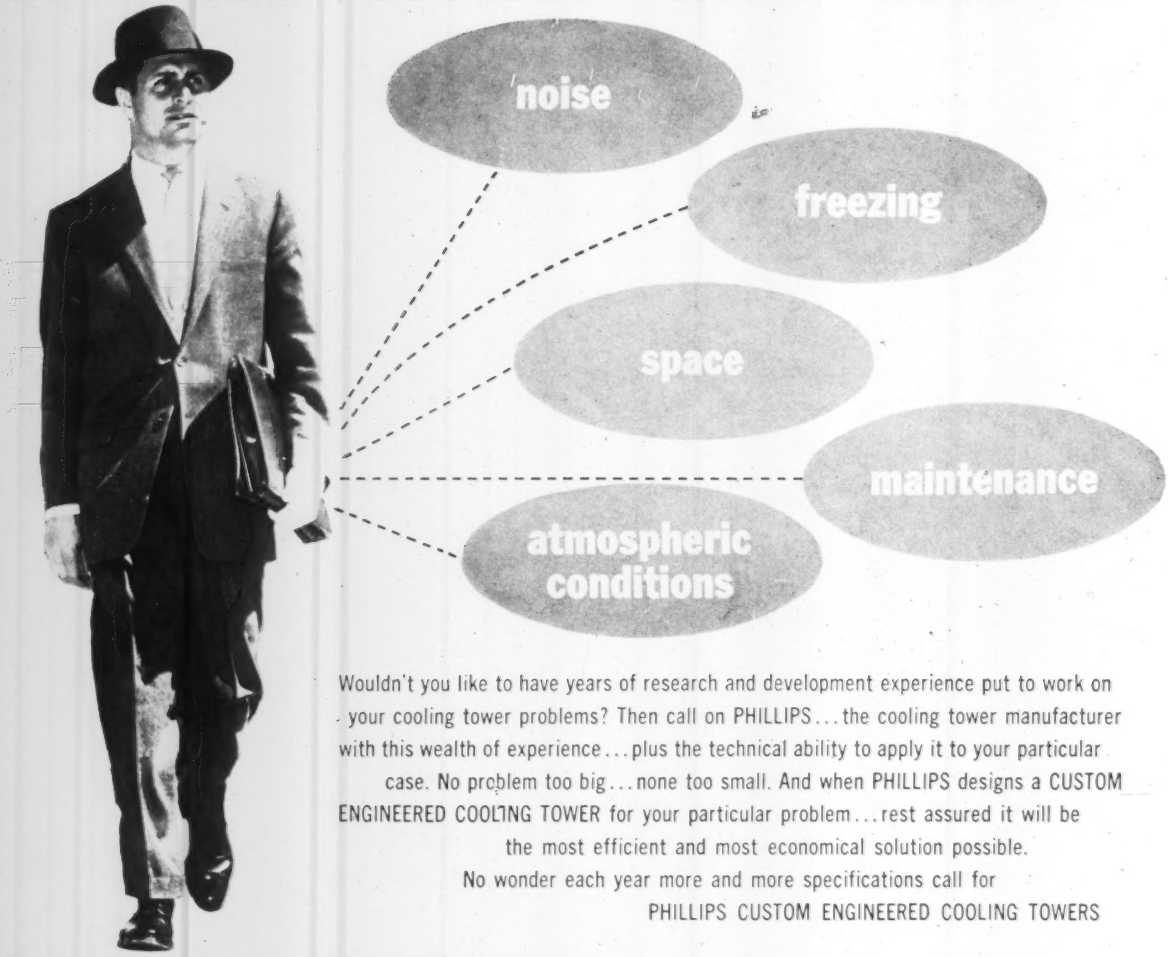

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EVERY STEP CUSTOM ENGINEERED

CASINGS
Selection of material to fit Architectural treatment and surrounding conditions.

BASINS
Redwood, stainless steel, galvanized steel, carbon steel up to and including ¼" thickness with any desired coating, reinforced concrete basins supported on steel beams.

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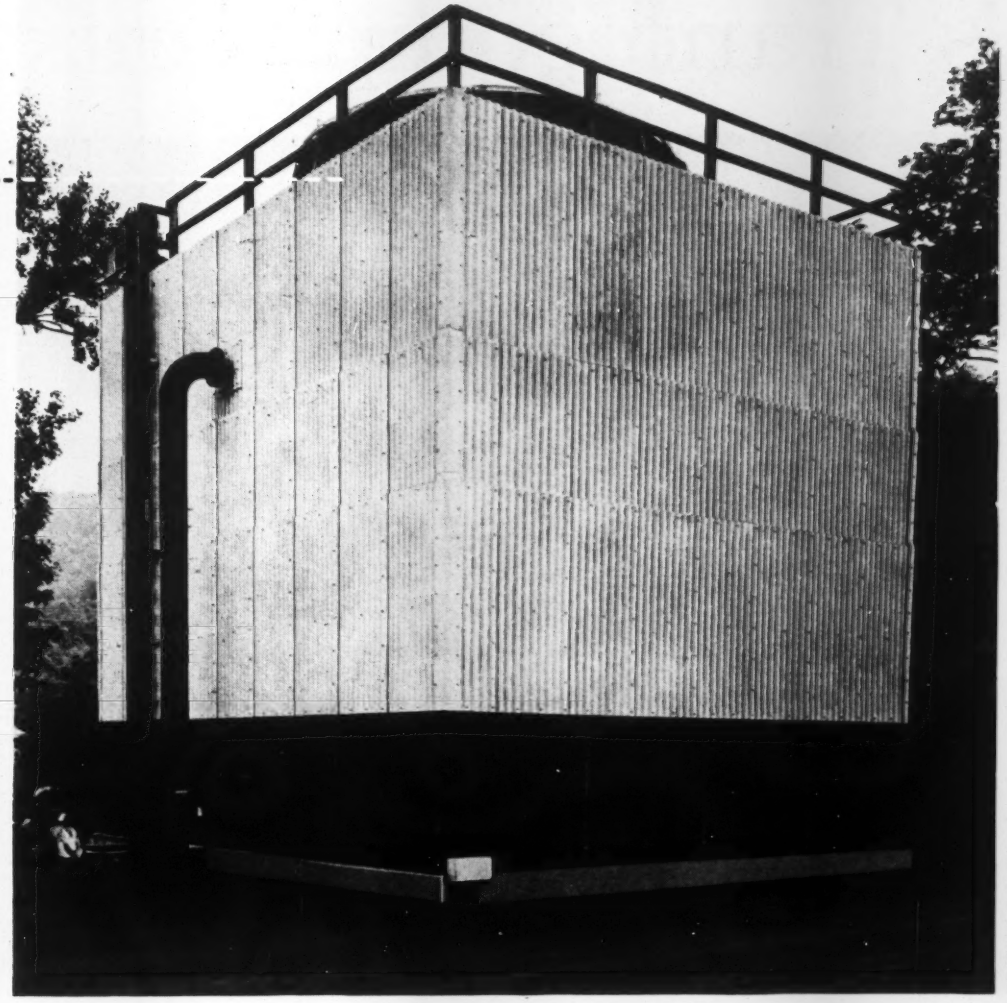
Spray nozzle type or open Weir gravitational type system.

FANS
Multi-blade, adjustable propeller type fan in cast aluminum, stainless steel or Monel. Either direct driven fan in small sizes or indirect right angle worm gear drives.

FILL
Redwood or pressure treated Douglas Fir. Slip-fit, self-supporting for easy removal for interior maintenance.

FRAMEWORK
Hot dipped galvanized structural steel .250" minimum thickness. Redwood or pressure treated Douglas Fir.



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THE PROBLEM:
To get maximum cooling with a limited concrete basin area in order to save on construction costs.

SOLUTION:
Phillips custom-engineered cooling tower with framing dimensions specially designed to use the maximum area with a minimum of concrete.

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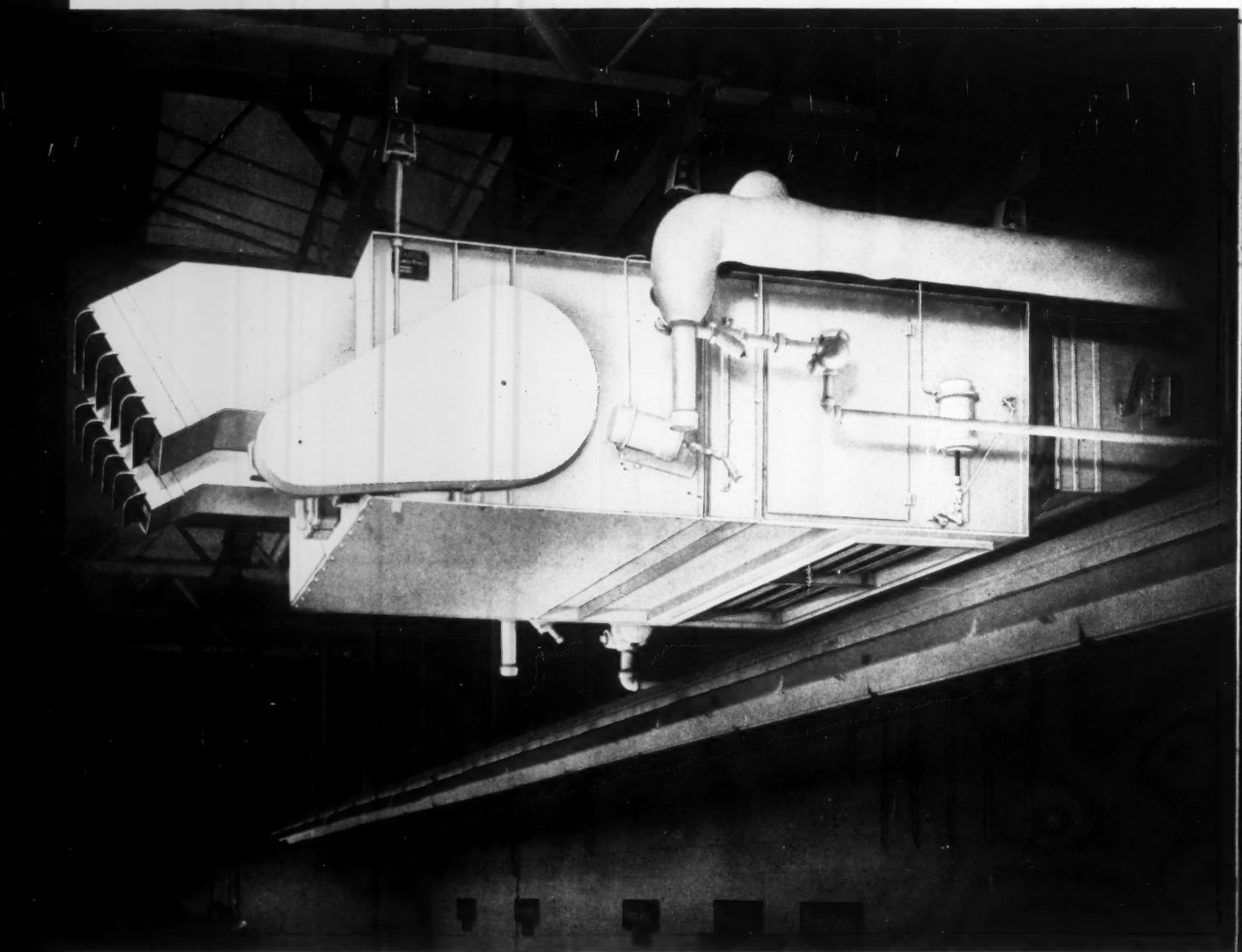
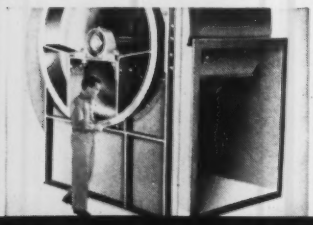
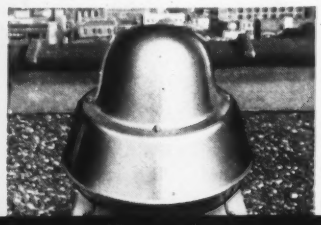
Wherever there's air there's Trane equipment



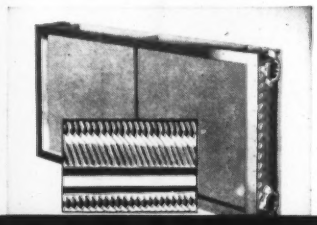
For high-pressure air conditioning systems . . . industrial processing and drying . . . TRANE Class III Fans save space, cut power costs. Complete range of 15 standard sizes from 18 to 73 inches, for static pressures up to 11½ inches. Capacities to 310,000 cfm. TRANE Fans are tested and rated under the NAFM code.



For ventilation . . . the new TRANE Centrifugal Roof Ventilator comes in 16 sizes, all with certified power ratings. All-new design with scientifically contoured inlet cone gives greater efficiency, more cfm with less power. Fan sizes from 7" to 40" wheel; streamlined, compact; shipped fully assembled, ready to install.



For built-up systems . . . TRANE Coils have exclusive Delta Flo Fin (inset) that eliminates stagnant air next to fin surface, increases heat transfer capacity. More efficient fins permit wider spacing for easier cleaning, reduced maintenance. Mechanical fin-to-tube bond is as strong as the metal itself!



to heat or move, to do the job

One source, one responsibility for every factory heating, ventilating need!

Now you can pinpoint responsibility for all your factory heating, ventilating needs with the complete TRANE line of *matched* equipment! That means you order from one reliable source . . . simplify purchasing, operation and maintenance.

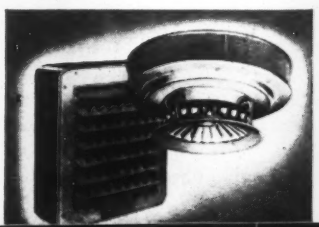
And now, the TRANE lines are more versatile, more complete than ever before! New Centrifugal Roof Ventilators . . . new Cabinet Fans . . . new Torrivent . . . new Steam Specialties . . . a wider range of sizes and models give you everything you need to handle *any* factory ventilating or heating job.

So when you plan, remember that TRANE equipment is *matched* equipment: designed and built together to work together! Whether it's a unit heater for a doorway or equipment for a complete heating-ventilating system, TRANE product lines are complete in every respect.

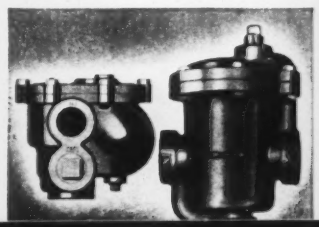
WANT MORE FACTS? Ask your nearby TRANE Sales Office or write TRANE, La Crosse, Wisconsin.

Heat and ventilate large areas with the modern TRANE Torrivent. Unit shown is installed in a garage, where it supplies fresh air and heat. Rugged and dependable, the Torrivent is installed with a fresh air intake duct, combination filter and mixing box so that it can supply any desired mixture of fresh and recirculated air—or recirculated air only, as needed. Note the pneumatically controlled face and by-pass dampers for tempering air . . . vibration isolators . . . standard 30° discharge nozzle with directional louvers. Unit shown is installed with TRANE Steam Specialties. Torrivents available in 9 sizes, capacities from 1,250 to 33,000 cfm.

For spot heating . . . TRANE Unit Heaters steer heat in any direction, any proportions, even *different* directions, proportions at the same time! Projection Unit (right) has Louver Cone Diffuser that gives up to 60% more throw. Horizontal Unit (left) has Louver Fin Diffuser for blanketing or spot throw.



To save fuel, stop waste, protect equipment . . . the complete line of TRANE Steam Specialties includes bucket traps, strainers, F and T Traps—plus vents and valves for all kinds of heating or process applications. TRANE equipment is *matched* equipment—designed and built together, to work together!



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Let us send you the informative new brochure, IN-155A. It gives you full details on Fibrocel's thermal performance. Illustrations show why Fibrocel installs easier . . . takes abuse, too. Keeps its fine appearance and performance excellence for the life of the installation. Write for it today!

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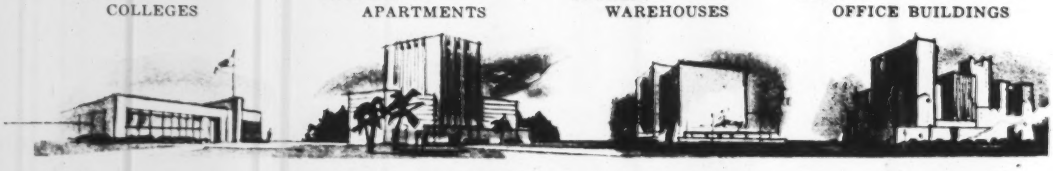

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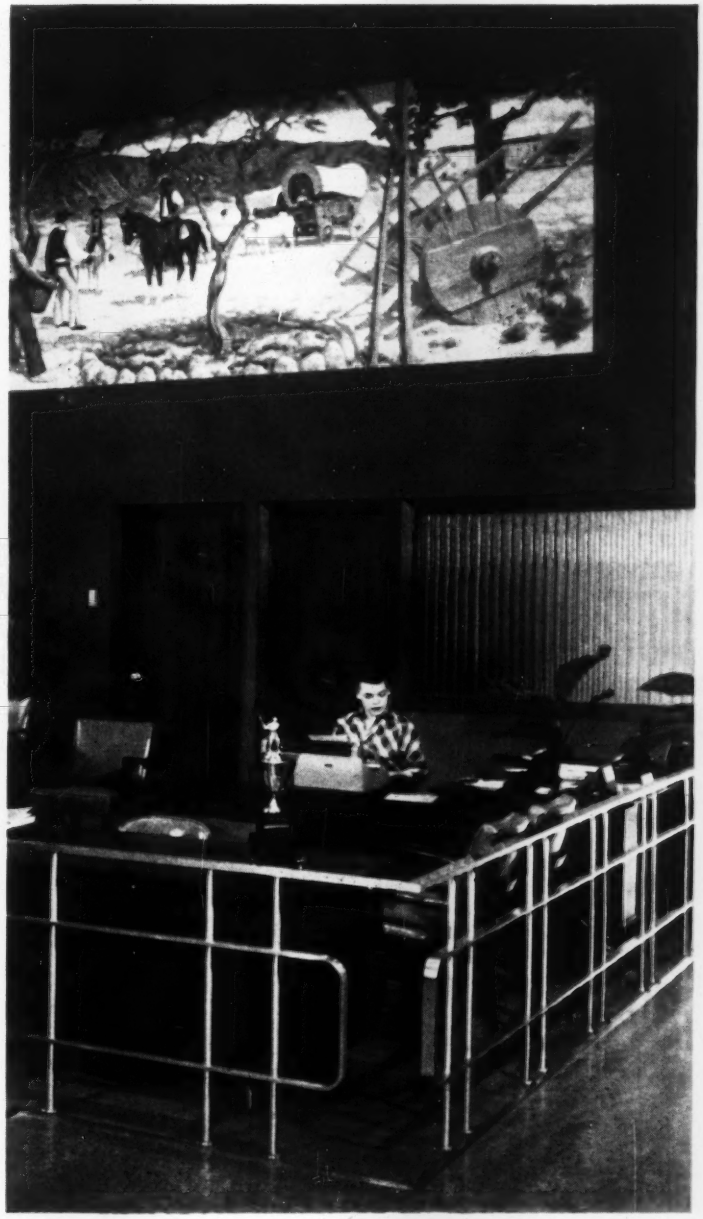
with **GAS**

. . . and saving too!

Arkla-Servel Gas Air Conditioning keeps work efficiency high and operating costs down at First Federal Savings in Alhambra, California.

"When planning our new main office in Alhambra, we made a complete survey of all types of air conditioning equipment," states First Federal. "Our answer was Arkla-Servel gas-operated water chilling units, and we're completely satisfied with the results.

"With our Arkla-Servel units, we keep our staff cool in summer with the same compact system that keeps them warm in winter," adds Mr. D. A.



Thompson, Sr. V.P. "We get top working efficiency at the lowest possible operating costs. And we get further savings because our Arkla-Servel unit is installed on the roof – utilizing otherwise useless space – and requires practically no maintenance."

Check the facts and you too will see that modern Gas air conditioning out-performs all others. For specific details call your local Gas Company's air conditioning specialist, or write to the Arkla Air Conditioning Corporation, General Sales Office, 812 Main Street, Little Rock, Ark. *American Gas Association.*

Check these features of the 25-ton Arkla-Servel water chiller

- Quiet and vibrationless . . . operates with no moving parts
- Low installation, operating and maintenance costs
- Can be installed singly or in banks to fit any need
- Compact and easy to install; light enough for rooftop installation

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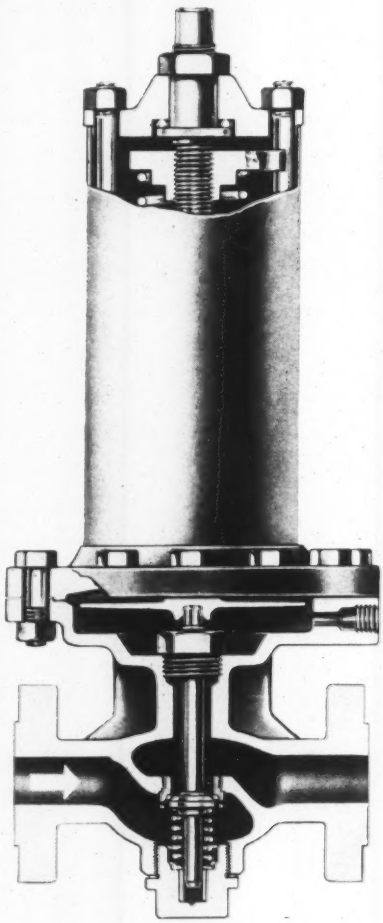
TWO NEW CONCEPTS IN

NEW LESLIE-TOPPER® VALVE DESIGNED WITH PILOTING DEVICE ENTIRELY *OUT OF THE PATH OF STEAM*

The new Leslie Topper self-contained pressure reducing valve offers a new level of accuracy, simplicity and low-maintenance service (see chart below). Key to this revolutionary valve is a piloting device which is entirely out of the path of steam. Because this mechanical pilot is sealed-off from the steam and all valve parts are designed without dirt-catching passages, the new Topper valve is ideal for both poor steam conditions and intermittent duty.

It can handle low-reduced pressures and is used in process lines, steam heat reducing stations and for make-up steam supply to heaters, gland sealing system and process equipment. You benefit from added reliability, plus the accuracy of a pilot operated valve and the rugged simplicity of direct operation. It means less shut-down time for maintenance, surer pressure control and increased plant efficiency.



SPECIFICATIONS

Sizes, Body Materials and End Connection:
½—2", cast iron, and bronze, screwed, 150 and 300 lb. bronze, flanged.
1—2" 125 and 250 lb. cast iron, flanged bodies.

Three Spring Ranges: *2-10 psi; 5-20 psi; 15-35 psi.*

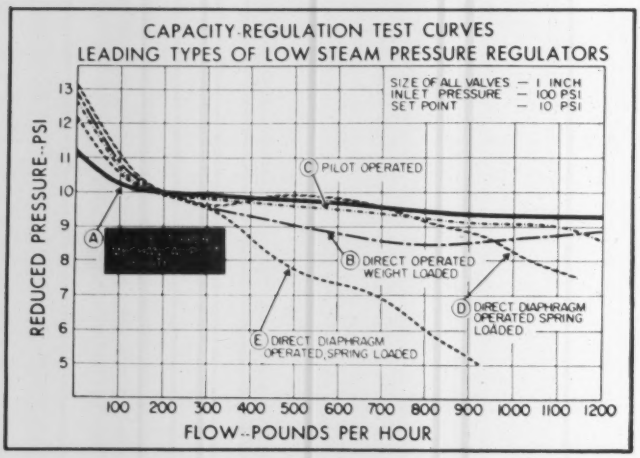
Long-travel metal diaphragm: *2 ply, phosphor bronze, Spiro-flex.®*

Main Valve: *Hardened 440C stainless steel.*

Seat Ring: *Stellited stainless steel.*

Stem Guides: *Gun metal bronze (top and bottom guided).*

Main Valve Spring: *Inconel.*



For sizing and capacity data, contact your Leslie Engineer or write for Bulletin 582.

LC-8

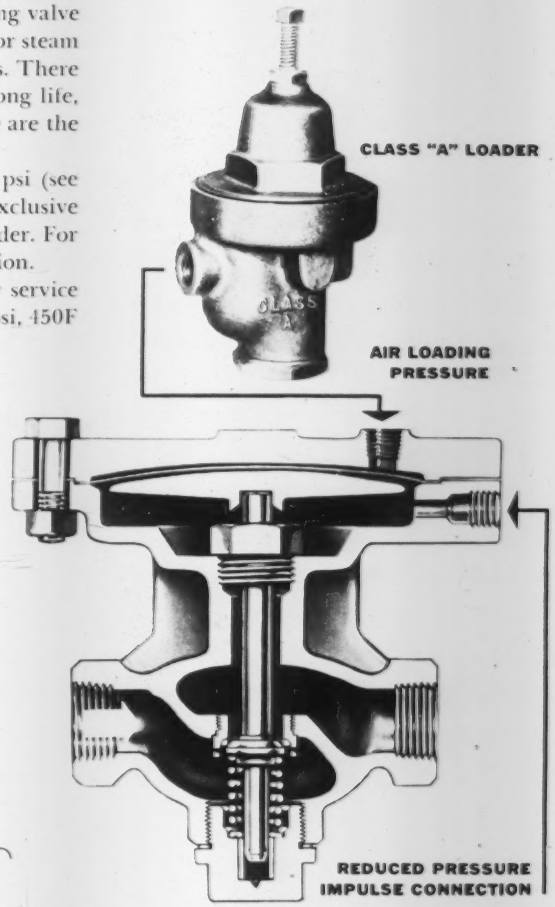
PRESSURE REDUCING VALVES

LESLIE AIR-LOADED REDUCING VALVE GUARANTEED MAINTENANCE-FREE FOR THREE FULL YEARS

New Leslie air-top GPK diaphragm operated, pressure reducing valve is guaranteed maintenance-free for three full years. Designed for steam heat or process steam application, it has only two moving parts. There are no seals, no stuffing boxes, no small dirt catching parts. Long life, long-travel diaphragm and hardened stainless steel main valve are the only parts that move.

You get accurate response even to flow changes as small as 0.1 psi (see chart below). This exceptional responsiveness results from exclusive diaphragm design and the accuracy of the simple Leslie air loader. For added flexibility, pressure can be adjusted from remote location.

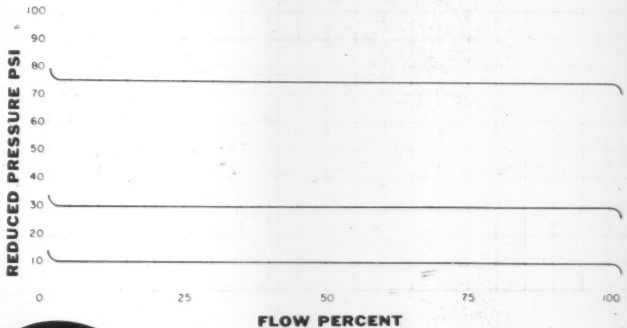
Especially desirable for poor steam conditions and standby service requirements, the GPK is suitable for steam service up to 250 psi, 450F and is available in ½" to 4" sizes.



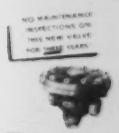
SPECIFICATIONS

Sizes: *½ to 2", cast iron or bronze, screwed ends. 2½, 3 and 4", cast iron, 125 or 250 lb. flanged.*
Main Valve: *Hardened 440C Stainless Steel.*
Seat Ring: *Stellited Stainless Steel.*
Stem Guides: *Gun Metal Bronze (top and bottom guided).*
Main Valve Spring: *Inconel.*
Inlet Pressure Range: *0-250 psi, 450°F.*
Reduced Pressure Range: *0-85 psi with Class A loader, up to 249 ½ psi with any suitable high pressure loader.*
Minimum Pressure Drop across Valve: *½ psi.*
Available with manual opening device in sizes ½—1¼".

CAPACITY-REGULATION GRAPH



For sizing and capacity data, contact your Leslie Engineer or write for Bulletin 561-B.



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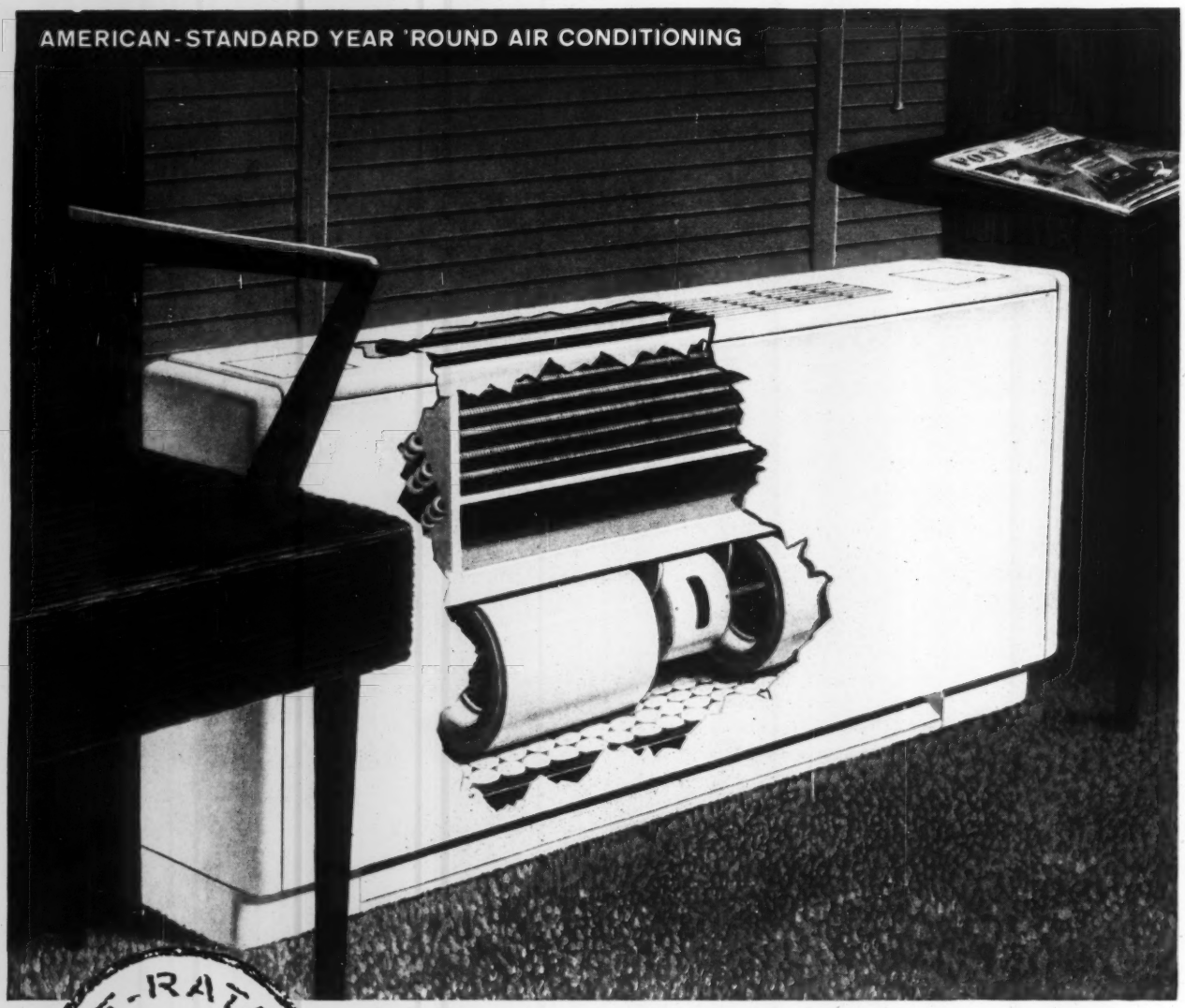
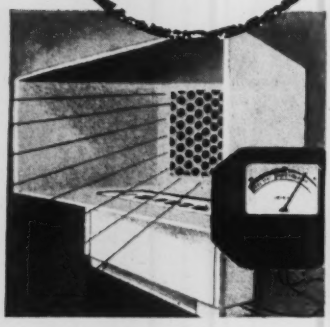
Over 275 Factory-Trained Engineers At Your Service—Nationwide!

AMERICAN-STANDARD YEAR 'ROUND AIR CONDITIONING

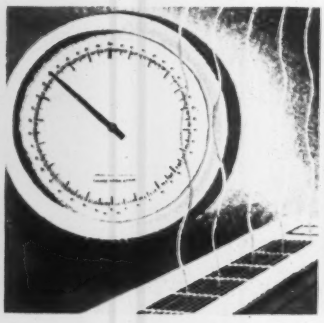


TEST-RATED by AMERICAN-Standard

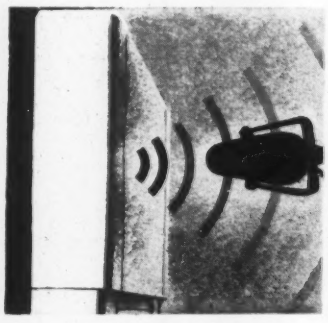
The Units: All units are a space-saving 9″ thin and 25″ low with individual room unit control for complete operating flexibility. They're available in three convenient models and four practical sizes, either recessed or free-standing. Remotaire units are exceptionally quiet because of slow-speed motors (1050 rpm max.), large coil surface and filter area, heavy insulation, no reactors or autotransformers.



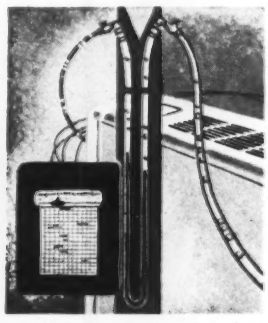
Tested for Air Capacity



Tested for Thermal Capacity



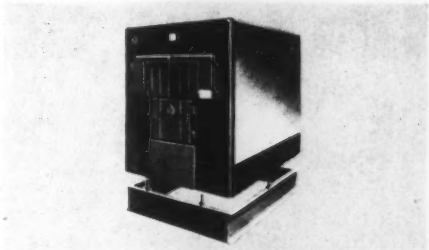
Tested for Quietness



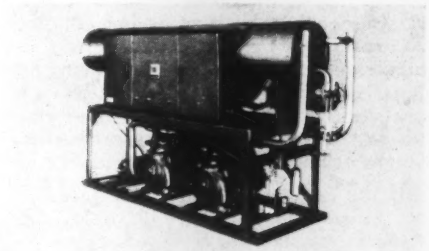
Tested for Humidity Control

AIR CONDITIONING

can deliver right up to its ratings— the Type 20 Remotaire proves it!



New A-7 cast iron boiler features exclusive optional steel pedestal base that eliminates need for pit or fire brick base. Sections tested at 2½ times normal operating pressure. Oil or stoker firing. I-B-R outputs of 866 to 2148 MBH.



Packaged water chiller is completely factory-assembled. Refrigerant circuit piped, control panel wired and entire unit tested. No field assembly needed. Available in complete range of sizes, from 7½ hp to 125 hp.

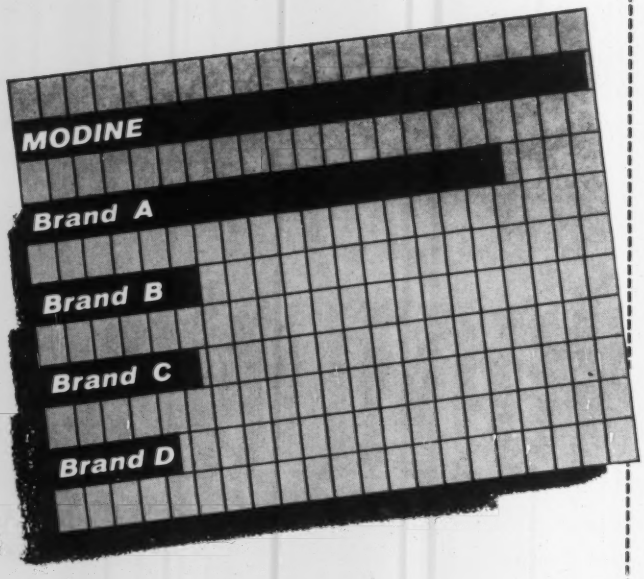
Here is a year 'round system with room units that deliver heating and cooling right up to their maximum ratings. American-Standard Remotaire units are thoroughly proved in rigidly controlled tests. Precise measurement is made of thermal capacity, water flow, pressure effects, condensate control, operating sound level, humidity limit and electrical characteristics. Each unit bears the U.L. Re-examination Service marker.

The System: Type 20 Remotaire is part of a hydronic system in which one set of small-diameter, flexible, space-saving pipes carries hot water for heating or chilled water for cooling from a boiler-chiller team to room units.

For full description and simplified capacity selection tables, see your American-Standard representative or write AMERICAN-STANDARD, PLUMBING AND HEATING DIVISION, 40 W. 40 St., New York 18, N. Y.

American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation

AMERICAN-Standard
PLUMBING AND HEATING DIVISION

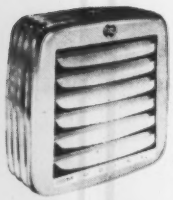


The chart represents the results of a steam and hot water unit heater survey made by a leading industrial magazine. In answer to the question "Which brand do you prefer?", Modine was a solid . . .

FIRST CHOICE

among men who buy unit heaters

HORIZONTAL
Can be direct-from-pipe suspended . . . without other supports. Vertical louvers may be added for complete directional control. 24 sizes.



VERTICAL
Available in 28 sizes . . . choice of 4 air deflectors. Depending upon size selected, mounting height may vary from 10 to 60 feet.

POWER-THROW®
For hard-to-heat locations. High-velocity discharge assures exceptionally long heat-throw . . . up to 140 feet. Offered in 10 sizes.

For over thirty years, Modine steam and hot water unit heaters have been a consistent first choice for commercial and industrial applications. They're ideal for new buildings or modernization . . . pay off in perfect comfort, at low fuel costs, with minimum maintenance.

Here are just a few of the features of Modine's line: attractive styling; three distinct designs . . . horizontal, vertical, Power-Throw; lightweight, yet extremely durable construction; high capacity on steam or hot water systems; die-formed casings; a complete line of low-outlet-temperature models for high pressure systems; extra-heavy die-formed fins for added strength and maximum heat transfer; vertical fin design that discourages accumulation of dust and dirt.

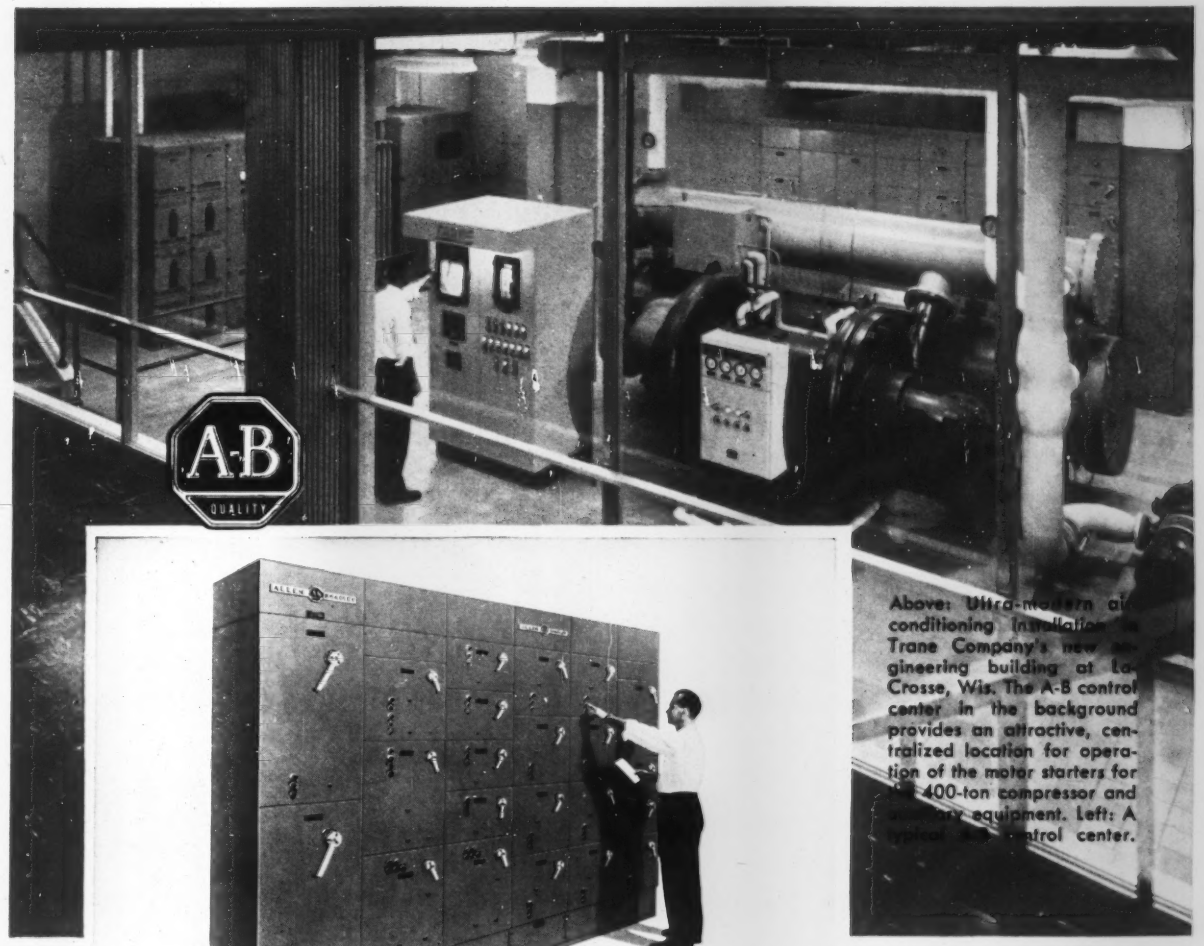
CATALOG 158 *contains full details. See your distributor or write Modine Manufacturing Co., 1509 DeKoven Ave., Racine, Wisconsin.*
In Canada: Sarco Canada, Ltd., Toronto, Ont.

Immediate delivery from local stock! Modine wholesalers are located in all principal cities. Call the Modine representative nearest you . . . he's listed in the yellow pages.

SU-1388

Also from the world's most complete unit heating line

Modine®
FIRST NAME IN UNIT HEATING



Above: Ultra-modern air conditioning installation in Trane Company's new engineering building at La Crosse, Wis. The A-B control center in the background provides an attractive, centralized location for operation of the motor starters for the 400-ton compressor and auxiliary equipment. Left: A typical A-B control center.

TRANE—specialist in air conditioning . . . uses

ALLEN-BRADLEY Motor Control

for its new engineering building

Manufacturers of electrically powered equipment are the *first* to realize how important reliable motor controls are to the performance of their installations. And to insure this desired reliability, more and more leading companies are turning to Allen-Bradley—the *quality* motor control.

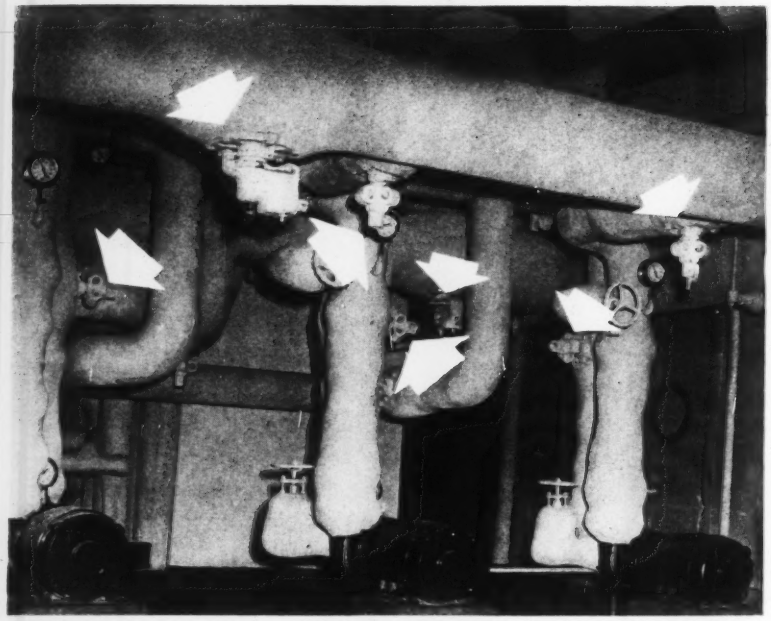
The simple solenoid design—for which Allen-Bradley starters, contactors, and relays are famous—has only ONE moving part. With virtually *nothing* to go wrong, you are assured millions of trouble free operations. There are no bearings, pivots, or pins to corrode and stick . . . no flexible jumpers to wear and break.

In addition, the double break, silver alloy contacts—a standard feature throughout the Allen-Bradley line—never need service attention. They are always in perfect operating condition . . . and remain so without maintenance until completely worn away. And *all* Allen-Bradley starters are equipped with two reliable and permanently accurate thermal overload relays to protect motors against "burnouts."

Guard against control failures on your equipment the way leading companies do—specify Allen-Bradley *quality* motor control. You *cannot* do better!

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

DeZURIK ..the BEST valve for air conditioning because.....



THEIR COMPACT SIZE MAKES INSTALLATION EASIER!

DeZurik Valves are made to order for the cramped quarters in which air conditioning systems are frequently installed. Their compact size provides a number of advantages. They weigh less — cutting down handling problems and making extra piping supports unnecessary. They fit easily into close quarters, with no long top-works to interfere with other piping. And they require less insulation.

This installation in the Baltimore County Court House (Egli and Gomph, Consultants) indicates how the compact size of DeZurik Valves solved a problem in tight quarters. They can do the same for you on your next installation.

Available in sizes ½" thru 20", in 2-way, 3-way or 4-way models with manual, on-off or positioning actuators. For more details, see the DeZurik representative in your area, or write Dept. AC for a complete list of installations.

DeZURIK CORPORATION
SARTELL, MINNESOTA

Only DeZurik Valves give you all these advantages:

1. Easy Operation
2. Drip Tight Shut-off
3. Low Pressure Drop
4. Best for Balancing
5. Low Installation Cost
6. No Maintenance
7. Proved Record of Dependability
8. Compact Size
9. Economically Priced
10. Versatility beyond compare

New Glass Fiber Duct Liner

Conforms to Strictest Fire Codes

ULTRALITE® Gustin-Bacon's well-known glass fiber duct liner, is now available with a newly developed-and-approved gray fire resistant coating. The new product carries a flame spread classification of less than 25 and complies with *all* requirements of the National Board of Fire Underwriters' Bulletin #90-A and B and the strictest fire codes.

ULTRALITE duct liner carries an Underwriters' Laboratories label. It is the only liner permanently stamped with density and flame spread classification . . . the only liner made exclusively of long strong textile-type glass fibers that impart extra strength, resilience and resistance to air erosion. All this—plus ULTRALITE'S famous thermal and acoustical efficiency—are now available at no greater cost than conventional coatings.

For specification data and samples, call your G-B distributor (listed in the Yellow Pages) or write

GUSTIN-BACON Mfg Co

220 W. 10th St. Kansas City, Mo.

Thermal and acoustical glass fiber insulations • Molded glass fiber pipe insulation • Couplings and fittings for plain and grooved end pipe

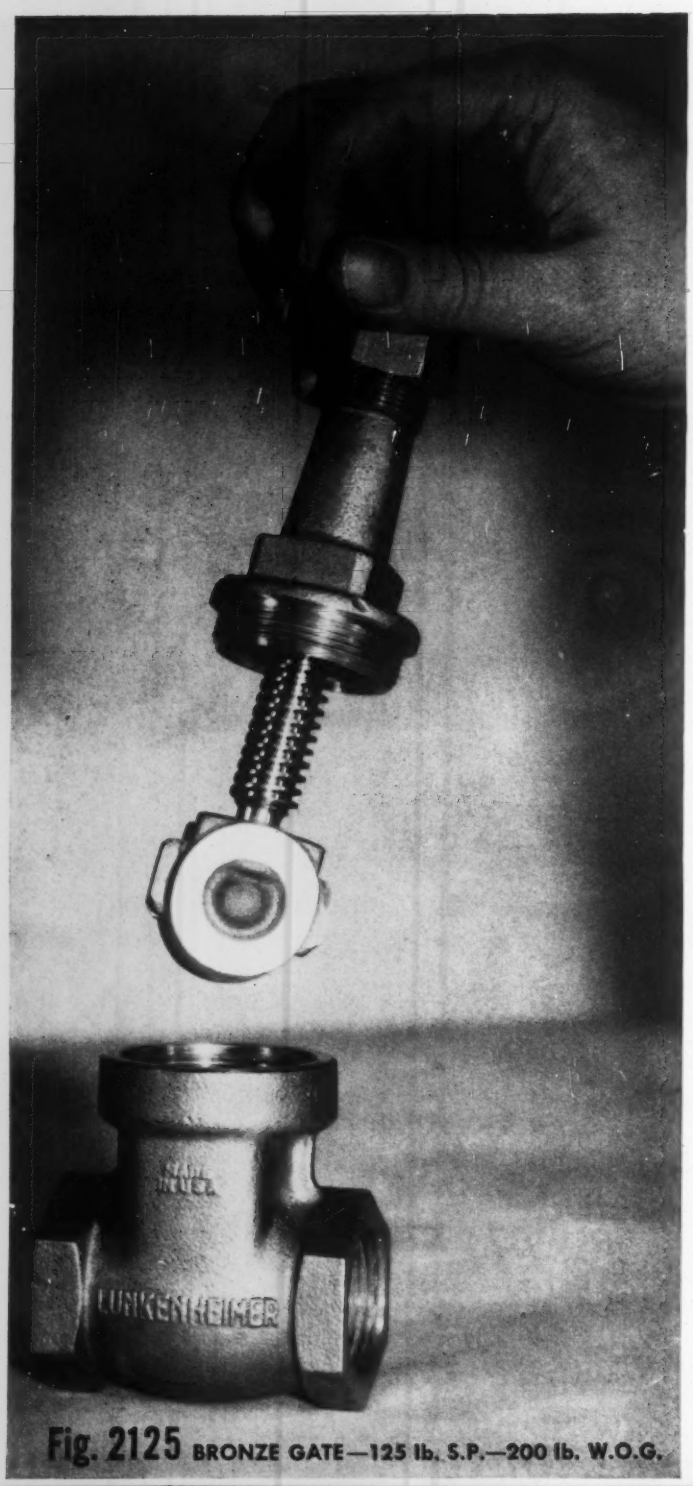


Fig. 2125 BRONZE GATE—125 lb. S.P.—200 lb. W.O.G.

SEE WHY LUNKENHEIMER BRONZE GATE VALVES CUT MAINTENANCE

What you pay to maintain a valve can exceed its original cost many times over. That's why it pays to examine the maintenance-saving features of Lunkenheimer Bronze Gate Valves.

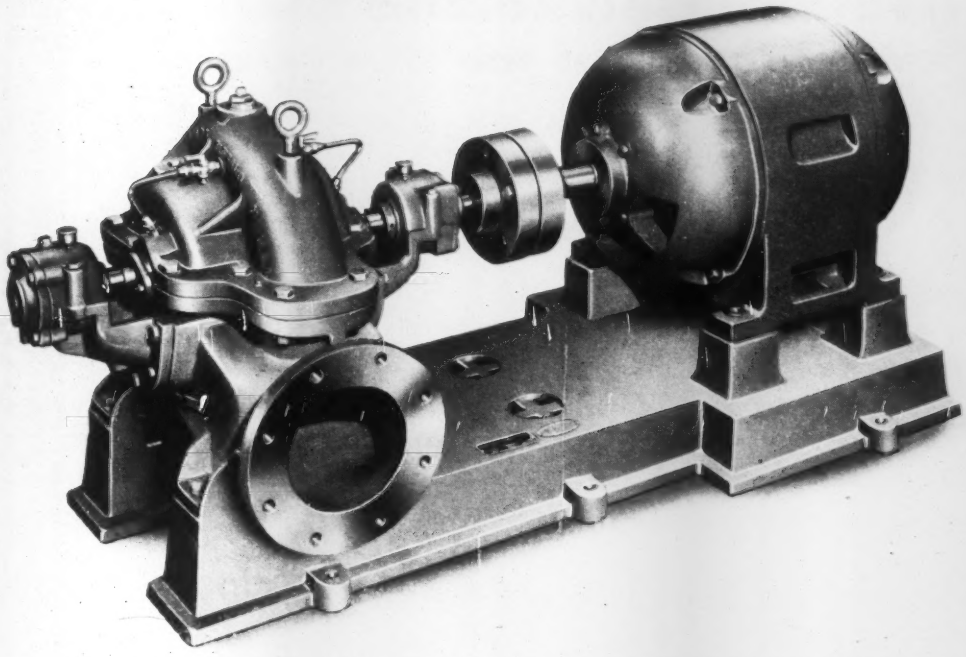
Stems are made of Stemalloy®, an exclusive Lunkenheimer alloy that assures longer stem thread life. Integral seats are precision tapered to insure perfect seating. Discs are compounded for long, wear-resistant service, machined to a high finish for smooth, trouble-free operation.

Let your Lunkenheimer Distributor show you the maintenance-saving features of Lunkenheimer Bronze Gate Valves and why you can't find the cost of a valve on a price list... Or write The Lunkenheimer Co., Cincinnati 14, Ohio.

LUNKENHEIMER QUALITY

LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES



"Buffalo" Double Suction Pump for Clear Water Service

3-WAY ECONOMY
WITH THESE "BUFFALO" PUMPS

1. Minimum Maintenance Cost 2. Minimum of Costly Time-Outs
3. Minimum Service Costs

"Buffalo" Double Suction Pumps bring you these and many more economies because they combine superior hydraulic design with the finest quality workmanship and materials.

Lower maintenance cost and fewer expensive time-outs are the result of these "Buffalo" construction features: sturdy, machined casing with ample, simply-formed water passages — hydraulically balanced impellers assuring peak efficiency — renewable bronze wearing rings — heavy-duty ball bearings and shaft is high grade steel, machined all over, bronze covered, or solid monel metal or other alloy.

Lowest possible service costs are assured by the extra accessibility designed into these pumps. Horizontally-divided casing permits quick removal of the upper half. Thus interior parts can easily be inspected or removed without disturbing pipe connections.

Add to these economies peak efficiency and dependability and you have a pump that is unsurpassed for the most severe industrial clear water service.

For full information on the "Buffalo" Double Suction Pump, contact your nearby "Buffalo" engineering representative. Or write for Bulletin 955-S.

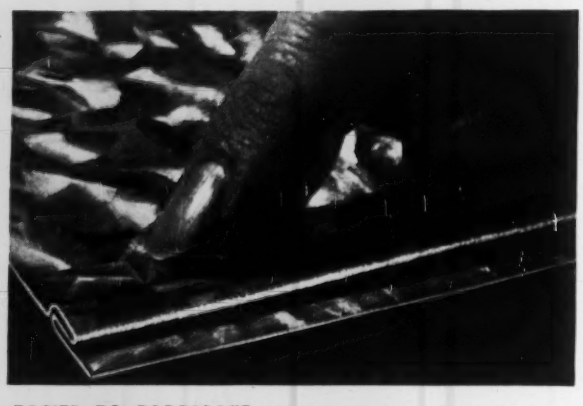
"Buffalo" PUMPS

BUFFALO PUMPS
Division of Buffalo Forge Co.
171 MORTIMER ST. • BUFFALO, N. Y.

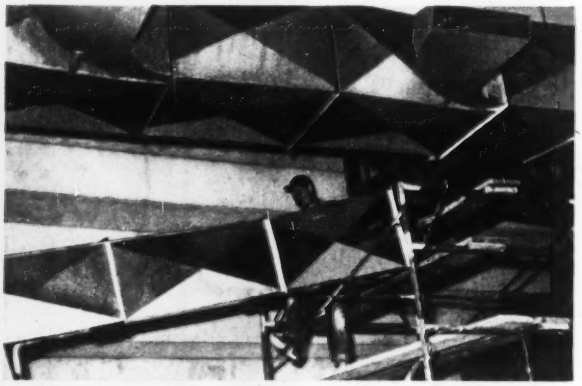
Canada Pumps, Ltd., Kitchener, Ont. • Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

Why Bethcon Galvanized Steel Sheets are just right for ductwork



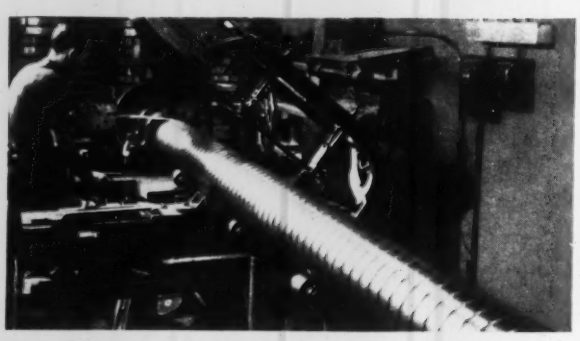
EASIER TO FABRICATE than other metals. Readily formed, easily joined by lock seams without tearing, buckling, or wrinkling.



MUCH LESS SUSCEPTIBLE to local surface damage in handling and working. Will not break or flake.

QUICKER TO INSTALL because the greater strength of steel allows longer lengths with fewer supports.

LESS NOISE because steel does not expand and contract as much as other materials.



MORE VERSATILE than comparable metals. Can be formed into spiral pipe, is readily soldered or welded right on the job.

MORE ECONOMICAL both in material and installation costs. Savings run as high as 30 pct over competitive metals.

Bethcon sheets are the product of Bethlehem's continuous galvanizing lines. They are strong but ductile; rigid but workable; rich-looking yet low in cost. Make your next heating, ventilating or air conditioning job a Bethcon job.

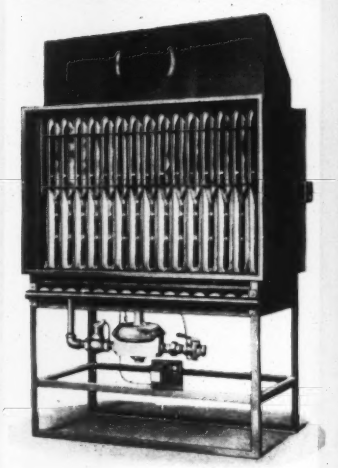
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

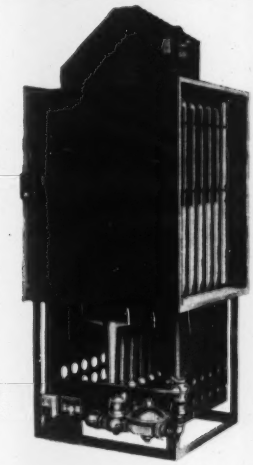
BETHLEHEM STEEL

BETHLEHEM STEEL

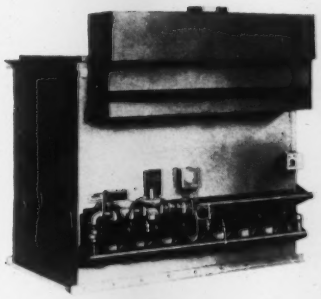
HAYES STAINLESS STEEL HEAT EXCHANGERS



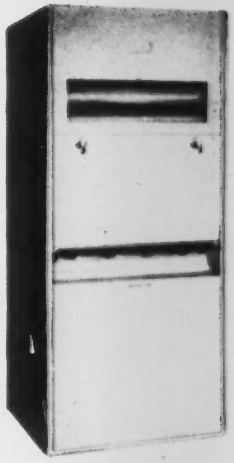
SED-E



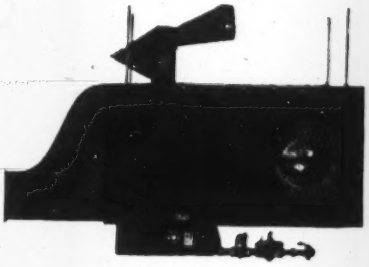
SED-S



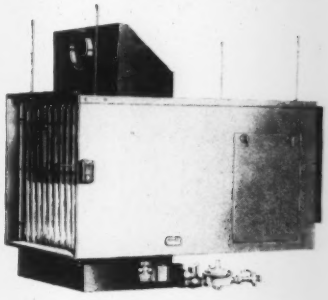
SED-VF



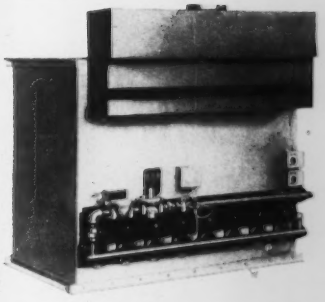
SEC



SEU



SES



SED-CF

SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation down-stream of cooling equipment, for continuous blower operation. Air through-put in either direction. 45,000 to 675,000 Btu input.

SED-S — Same as SED-E except controls are at the side. Either SED-E or SED-S is available in sizes from 45,000 to 675,000 Btu input in increments of 45,000 Btu.

SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. 7 sizes from 70,000 to 280,000 Btu input.

SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower. 7 sizes — 70,000 to 245,000 Btu input. For zero clearance.

SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 480,000 Btu input.

SES — Forced air, suspended furnace for installation in suspended duct system. Designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

SED-CF — Tested and approved as a duct furnace for counterflow. Recirculating fresh air thru the top. Has a built-in bypass. Sizes from 70,000 to 280,000 Btu input.

—REPRESENTATIVES EVERYWHERE—

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SAN JOSE: Central Service Co., Inc.
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FURNACES

outstanding for commercial, industrial, schools, churches, theaters, large residential.

HAYES FURNACE MFG. & SUPPLY CO.

3338 So. La Cienega Blvd., Los Angeles 16, California
Telephone TExas 0-5704

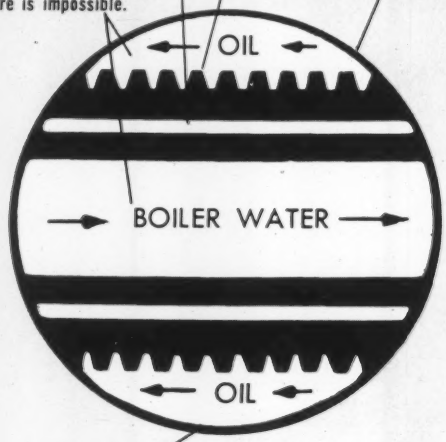
HOW TO USE BOILER WATER DIRECTLY IN A NO. 6 FUEL OIL HEATER WITHOUT DANGER OF SYSTEM CONTAMINATION

THERMO-FILM* —the safety barrier heat transfer liquid—is extremely thin to maintain maximum heat transfer.

EXTENDED SURFACE of outer tubes substantially reduces size and weight of heater.

COMPLETE ISOLATION of boiler water and fuel oil is accomplished by a coaxial tube assembly, with heat-transfer liquid between inner and outer tubes. **Boiler contamination in event of oil tube failure is impossible.**

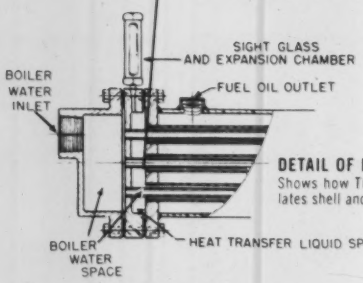
100% COUNTER FLOW results from straight tube construction. Heated oil exits at end where boiler water enters at its highest thermal head—another design feature assuring maximum overall heat transfer.



This Paracoil Thermo-Film* fuel oil heater permits direct use of boiler water and fuel oil in the same shell. Design safely isolates oil and water circuits. Oil leak cannot contaminate boiler stream. This diagram explains the heater's remarkable efficiency.

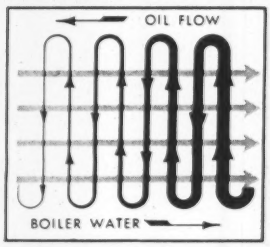
IMPROVED INDICATOR immediately reveals presence of oil in heat transfer liquid in the unlikely event a leak should occur.

PARACOIL "THERMO-FILM" SAFETY BARRIER FUEL OIL HEATER
Low pressure model—for gravity or forced circulation of boiler water. Provides maximum capacity with minimum size. Also available but not shown: high pressure models, for use with high temperature hot water or steam as the heating medium.



DETAIL OF END CHAMBER
Shows how Thermo-Film* isolates shell and tube side fluids.

INTERNAL TURBULENCE
Oil, with low pressure loss, passes in baffled flow across heating tubes — further increasing heat transfer rates and reducing bulk of the heater. (Thickness of oil flow line represents viscosity).



*Trade Mark Reg., U.S. Patent Office

Paracoil HEAT TRANSFER EQUIPMENT

For details, write for Bulletin 60-N

DAVIS ENGINEERING
(A Division of American Metal Products Company)
520 Main Avenue, Wallington, N. J.

AN amp SUBSIDIARY

Friendly Symbol of Fresh, New Service: Look for UCON IKE !

UCON IKE stands for America's newest refrigerants—top-quality UCON Brand Refrigerants. *Plus* a brand-new approach to service . . . backed by a published marketing policy.

You'll like the people who make this policy work for you. They're friendly, competent, imaginative people, who know and care about your problems.

The service they provide is what makes the *real* difference in refrigerants!

UCON Refrigerants: 5 top-quality grades; full range of unit sizes; color-coded at the top; personalized service.

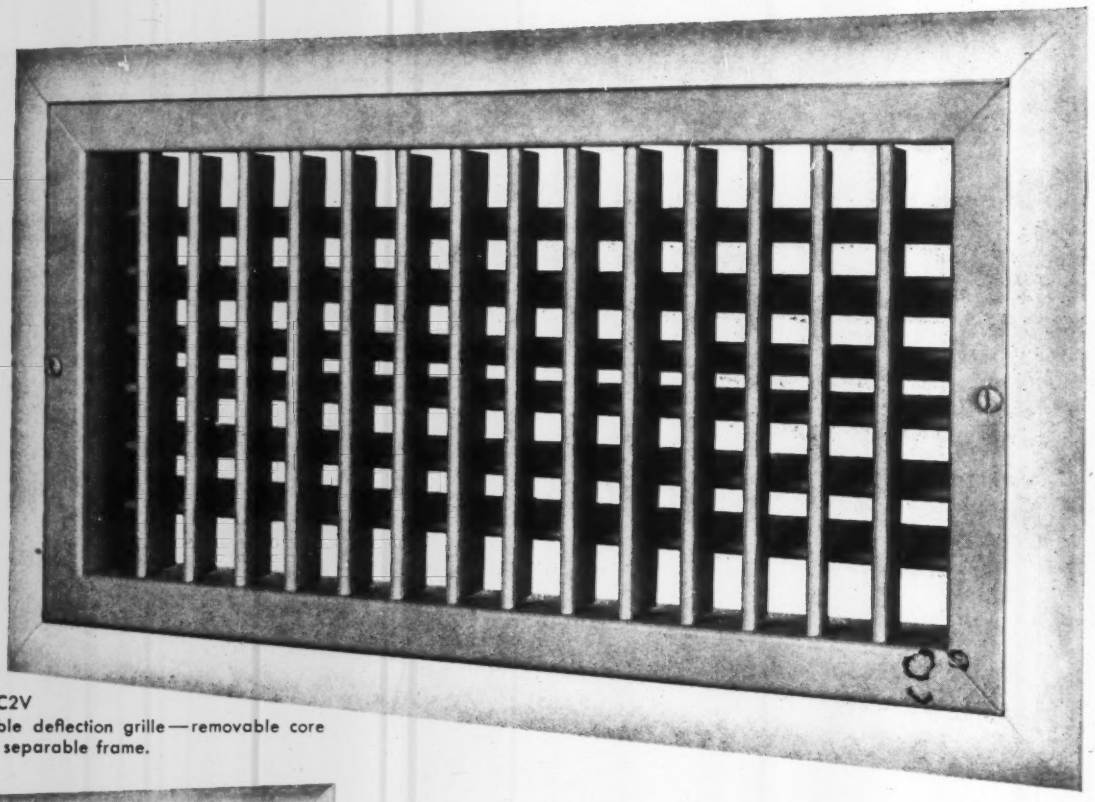
UCON Brand Refrigerants are manufactured by
UNION CARBIDE CHEMICALS COMPANY—Division of Union Carbide Corporation
30 East 42nd St., New York 17, N. Y.
Exclusive Sales Agent to Air Conditioning and Refrigeration Wholesalers
ANSUL CHEMICAL COMPANY, Marinette, Wisconsin

UCON and UNION CARBIDE are registered trade marks of Union Carbide Corporation

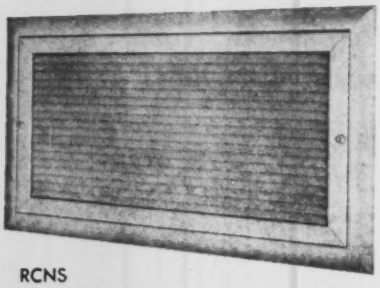
UNION CARBIDE product · Ucon BRAND refrigerants · exclusive sales agent ANSUL

Now... WATERLOO *presents*

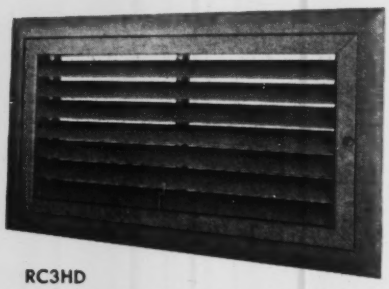
removable core grilles



RC2V
Double deflection grille—removable core with separable frame.



RCNS
"No-Site" inverted V shaped blades with removable core and separable frame.



RC3HD
Return air grille with fins fixed at 45° with removable core and separable frame.

Completely removable cores— unique design separable frames

Designed to enhance all modern interiors, these new Waterloo removable core grilles offer many significant advantages:

1. Cores slip out easily—prevent damage to plaster or painted walls.

2. Unique design separable frames allow maximum free area. Trim radius edges of frames add streamline appearance to room decors.

3. Removable core grilles are either all aluminum construction or separable aluminum frames with conventional cores. Either type may be specified.

4. Waterloo removable cores are available with models shown or on any other Waterloo supply and return grilles or registers.

Reap these benefits by specifying Waterloo removable core grilles on your next job. *Write for new comprehensive Waterloo Catalog.* WR-110

WATERLOO
Air Diffusion
EQUIPMENT

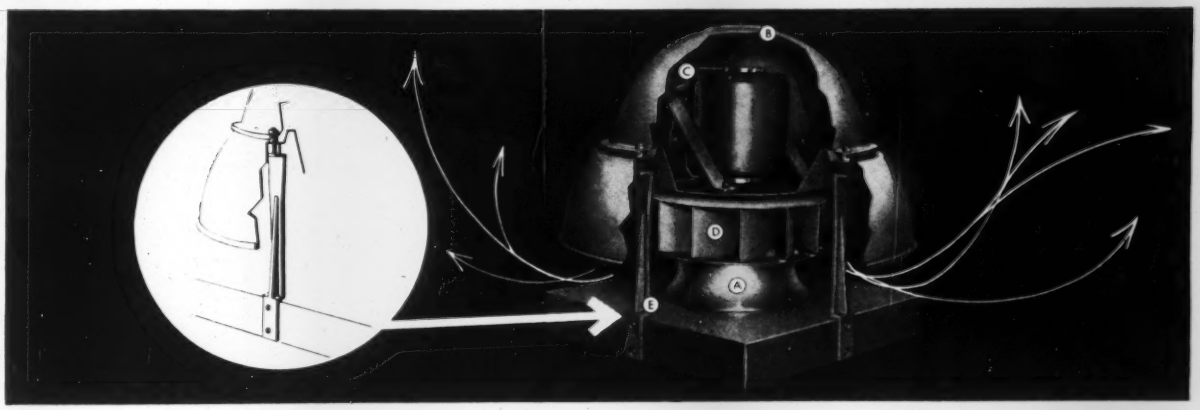
WATERLOO REGISTER COMPANY, INC.
WATERLOO, IOWA

COMPARE EXITAIRE

curb-mounted brackets for extra rigidity

another superior feature of **Exit Aire**

the complete line of power roof ventilators



Exit Aire exhausters welcome feature-by-feature comparisons because they demonstrate so well why EXIT-AIRE gives the finest ventilation at modest cost.

Compare the performance features of the EXITAIRE with those of any other ventilator. Take CURB-MOUNTING, for example...

The EXITAIRE unit is solidly suspended by 4 sturdy cast-aluminum brackets attached directly to the curb. Compare with units which have dissimilar metal vibration mountings resting directly on spun aluminum housings, subjecting the units to electrolysis between the dissimilar metals, which may cause deterioration or collapse. With EXIT-AIRE, the motor compartment is insulated from vibration to curb by individual Neoprene "sandwich" dampeners for silent vibrationless operation! Motor is resiliently mounted. No need for rubber curb mountings.

feature by feature—compare ExitAire:

A. NEW "AIRE-FLOW" INLET CONE similar to centrifugal blower-type for maximum efficiency, with air turbulence reduced to a minimum. Allows use of smaller wheel which is quieter in operation and easier to balance.

B. LOW SILHOUETTE conforms with modern architecture!

C. DISCONNECT SWITCH provided for mounting in motor compartment. Standard on single speed unit 10" and larger.

D. NEW WHEEL DESIGN delivers more capacity, per HP rating, than conventional wheels! Small size enhances balance.

E. COMPLETE CURB-MOUNTING! An *integral* part of unit, no extra cost!

EXITAIRE GIVES YOU CERTIFIED PERFORMANCE RATINGS, TOO! ExitAire Power Exhausters carry the Certified Rating Seal of the Air Moving and Conditioning Association... Underwriters' Laboratories, Inc. listing on most power units. You can be *sure* when you specify ExitAire!

compare—you'll buy ExitAire

Exit Aire COMPANY

P.O. BOX 276, PACOIMA, CALIFORNIA

ExitAire Company
P.O. Box 276, Pacoima, California

Please send me by return mail your Bulletin 659, A.I.A. File No. 12K2, with complete specifications and engineering data on ExitAire. There is no charge or obligation.

Name_____

Company_____

Street_____

City_____ Zone____ State_____

steel pipe

keeps the steel blades flying

This blossoming business of community ice skating has grown into a sizeable—and profitable—market. Best assurance of profitability for the installation of an ice-making system is the elimination of costly maintenance and repairs. It's a job that calls for strong, durable *steel pipe*.

With dependable *steel pipe* there's no danger of damaging the refrigerant lines, no bending and sagging. *Steel pipe* has *proved* its place in many applications like this.

Whenever there's a new application, it pays to stay with dependable, time-tested materials. The skating rink is just another example of the many kinds of jobs that *steel pipe* can do *best*.

STEEL PIPE IS FIRST CHOICE

- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

INSIST ON PIPE MADE IN U.S.A.

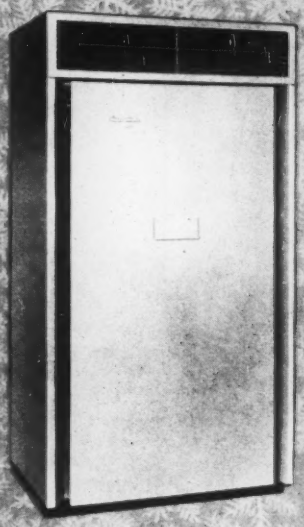
COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

150 East Forty-Second Street, New York 17, N.Y.

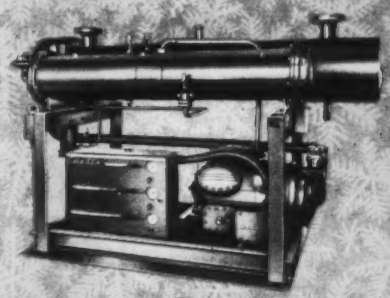
Curtis

CONDITIONS COMMERCIAL AMERICA...



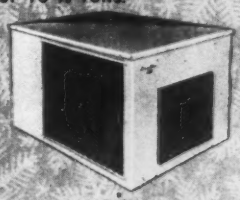
Curtis packaged units minimize floor area required. Factory assembled and tested. Field installation requires only setting and connecting utilities.

PACKAGED AIR CONDITIONERS UP TO 100 TONS.



PACKAGED LIQUID CHILLERS UP TO 100 TONS.

AIR-COOLED UNITS UP TO 10 TONS.



PRECISION

close tolerance manufacturing, builds peak performance into every CURTIS unit.

Curtis is the "luxury line" in the air-conditioning industry. Silence, efficiency and long-life are inherent in Curtis design.

Yet Curtis prices are right in line.

This is why Curtis designs and builds thousands of unique air conditioning systems for commercial America . . . why Curtis is able to maintain a family of over 300 representatives and servicing contractors across the nation.

Put the advantages of CURTIS PRECISION into your next job.

Curtis

MANUFACTURING COMPANY
REFRIGERATION DIVISION

OUR 105th YEAR

WRITE DEPT. 5, ST. LOUIS 20, MISSOURI

THE CURTIS "LUXURY LINE" OF AIR CONDITIONERS COSTS NO MORE

Valves that will Last here are a wise buy for Any building

Engineering & Design:
CENTRAL ENGINEERING DIV., BOISE CASCADE CORP.

Consulting Structural Engineer:
R. M. TRACEY & ASSOCIATES, SEATTLE

General Contractor:
SWINERTON & WALBERG CO., SAN FRANCISCO

Mechanical Contractor:
ENGINEERS LIMITED CO., SAN FRANCISCO

New **CASCADE KRAFT** Pulp and Paper Mill

chose JENKINS VALVES

on a proved record of stamina in severe duty

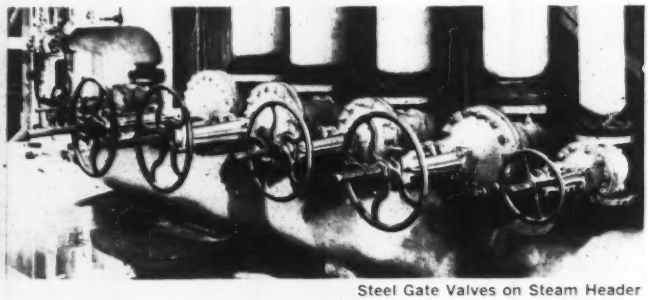
Few valve services are so rigorous as pulp and paper making. And few pulp and paper mills have been planned with so much know-how and care as the new Wallula, Washington mill of the Cascade Kraft Corporation, a subsidiary of Boise Cascade Corporation. *"Best of its kind"*, was the directive covering everything from the eight-story high boiler to the kraft paper making machine as long as a football field to the valves and other accessory equipment.

The corporation's engineers, from experience that includes many of the country's famous paper mills, chose JENKINS Valves to control the transfer of pulp liquors and stock, high pressure steam, water, air and for fire protection service. The choice was based on the proved reliability and economy of Jenkins Valves in severe duty.

Surely, valves with the stamina to stand such severe duty are a wise choice for ANY plant or building . . . especially since Jenkins Valves cost no more. Jenkins Bros., 100 Park Ave., New York 17.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES

JENKINS ® SINCE 1864 Jenkins Bros

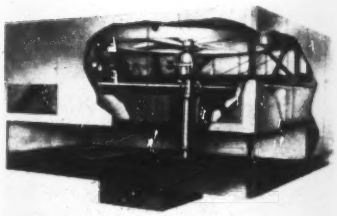


Steel Gate Valves on Steam Header

Sold Through Leading Distributors Everywhere

EQUIPMENT DEVELOPMENTS . . .

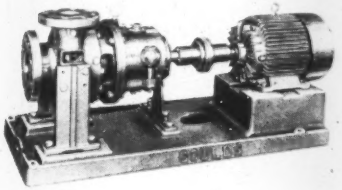
For reviews of Recent Trade Literature see page 224



Cooling Tower . . .

. . . using new material to speed transfer of heat to air — *Carrier Corp., Dept. HPAC, Syracuse 1, N.Y.*

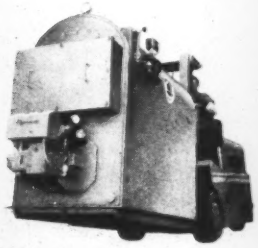
Produced in 9 sizes between 170 and 500 tons capacity featuring rotating sprinkler, low floor area requirements and light weight. Available in galvanized sheet steel, stainless steel, cement-asbestos, glass fiber, or coated metal.



Centrifugal Pump . . .

. . . for use in hot water heating, process piping applications — *Goulds Pumps, Inc., Dept. HPAC, 57 Black Brook Rd., Seneca Falls, N.Y.*

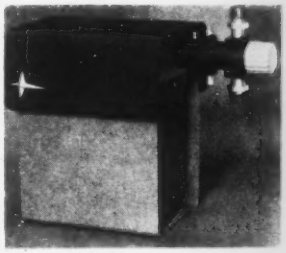
Available in 11 sizes, maximum pumping capacity 850 gpm at temperature of 600 F and 550 psi. Hydrostatic test pressure of pump is 1100 psi.



Packaged Boilers . . .

. . . featuring forced-draft firing — *American-Standard Industrial Div., Dept. HPAC, Detroit 32, Mich.*

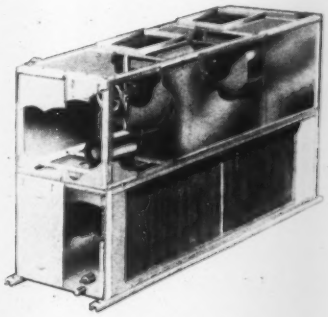
Boilers cover range of net steam ratings from 1010 to 5620 sq ft EDR and water from 243 to 1350 MBtu per hr, firing natural, mixed, or LP gas, or No. 1 or No. 2 fuel oil, or combination gas/oil. Units feature front-mounted control panel providing selector switch for instant fuel change-over on combination gas/oil units.



Proportioning Pump . . .

. . . for chemical treating of boiler makeup water — *B-I-F Industries, Inc., Dept. HPAC, 345 Harris Ave., Providence 1, R.I.*

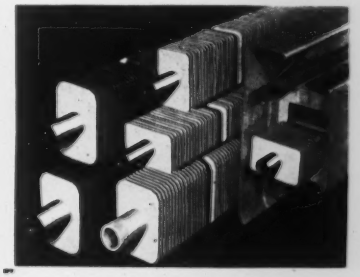
Design includes adjustable stroke length for feed rates from 0.2 to 2 gph into 300 psi maximum discharge pressure. Uses steel cylinders and check valve bodies, stainless steel plunger, ball checks and seats; operates on 110 volts.



Air Conditioning Units . . .

. . . for central station, single-zone application — *Drayer-Hanson Div., National-U. S. Radiator Corp., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

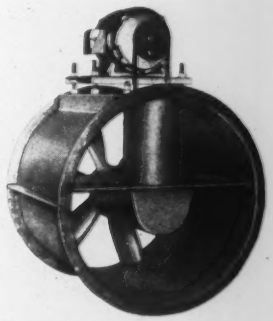
Currently in 30 models, vertical, and horizontal; each type now available in capacities 500 through 35,000 cfm. Construction is modular, all-welded angle-iron frame with separate sections for fan, coils, filters.



Baseboard Radiation . . .

. . . using one size enclosure to accommodate 5 different finned tube heating elements—*Rittling Corp., Dept. HPAC, Buffalo 5, N. Y.*

Heating elements available in 3/4 to 1 1/4 in. Dimensions and capacities available in bulletin "R-596."

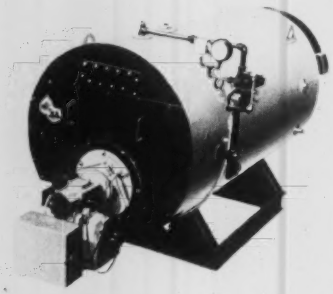


Duct Fans . . .

. . . offering resistance to corrosion—*Hartzell Propeller Fan Co., Dept. HPAC, P. O. Box 909, Roosevelt Ave., Piqua, O.*

EQUIPMENT DEVELOPMENTS
Continued

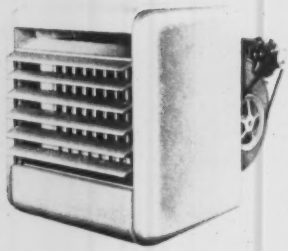
Propeller, duct section, drive housing and bearing cover of glass fiber, drive shaft and hardware of stainless steel; features variable pitch drives, made in 20, 24, 28 in. diam. Descriptive bulletin "A-116" available from manufacturer.



Scotch Boilers . . .

. . .available in 20, 30, 40, 50, and 60 hp models — *National-U.S. Radiator Corp., Dept. HPAC,* 944 *Ash St., Johnstown, Pa.*

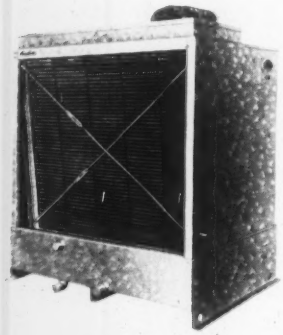
Provides 5 sq ft fireside heating surface and 80 percent thermal efficiency certified by manufacturer. Packaged units are available for oil, gas, or combination oil gas firing with net ratings from 199,000 to 1,198,000 Btu per hr. Descriptive bulletin "1016" available on request.



Gas-Fired Unit Heaters . . .

. . .with slow-speed centrifugal fans — *Westinghouse Sturtevant Div., Dept. HPAC,* 200 *Readville St., Hyde Park, Boston* 36, *Mass.*

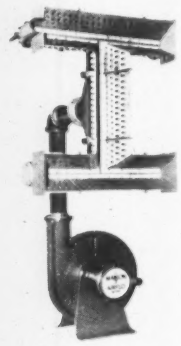
Available in two types — free delivery units with adjustable louvers for effective air distribution in proximity of unit — ductwork units for distribution to remote areas. Ratings from 40,000 to 200,000 Btu per hr in eight models. Catalog "1526" available on request.



Cooling Tower . . .

. . .designed for easy cleaning and maintenance — *Acme Industries, Inc., Dept. HPAC,* 600 *N. Mechanic St., Jackson, Mich.*

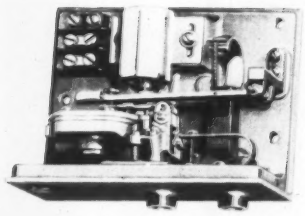
Plastic deck consists of series of high impact polystyrene drip trays (which cannot warp) stacked in housing, each of which has more than 600 controlled drip spouts maintaining constant flow. Tower can be disassembled and reassembled in minutes.



Gas Burner . . .

. . .with 25 to 1 throttling range — *Maxon Premix Burner Co., Dept. HPAC,* 201 *E. 18th St., Muncie, Ind.*

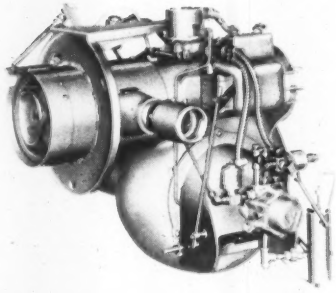
Burner operates on principle of using some oxygen from stream of air being heated; may be used on either re-circulating or single-flow systems; stainless steel mixing plates mounted directly in duct carrying stream of air. Descriptive bulletin available on request.



Load Limiting Relay . . .

. . .to protect motors on centrifugal refrigeration compressors — *Johnson Service Co., Dept. HPAC,* 507 *E. Michigan, Milwaukee* 1, *Wisc.*

Limits output capacity of compressor to full load motor ampere rating and can be adjusted for any current value between 3 and 7 amps. Used with current transformer can control compressor motors of any size. Bulletin "V-26" available on request.



Pressure Burner . . .

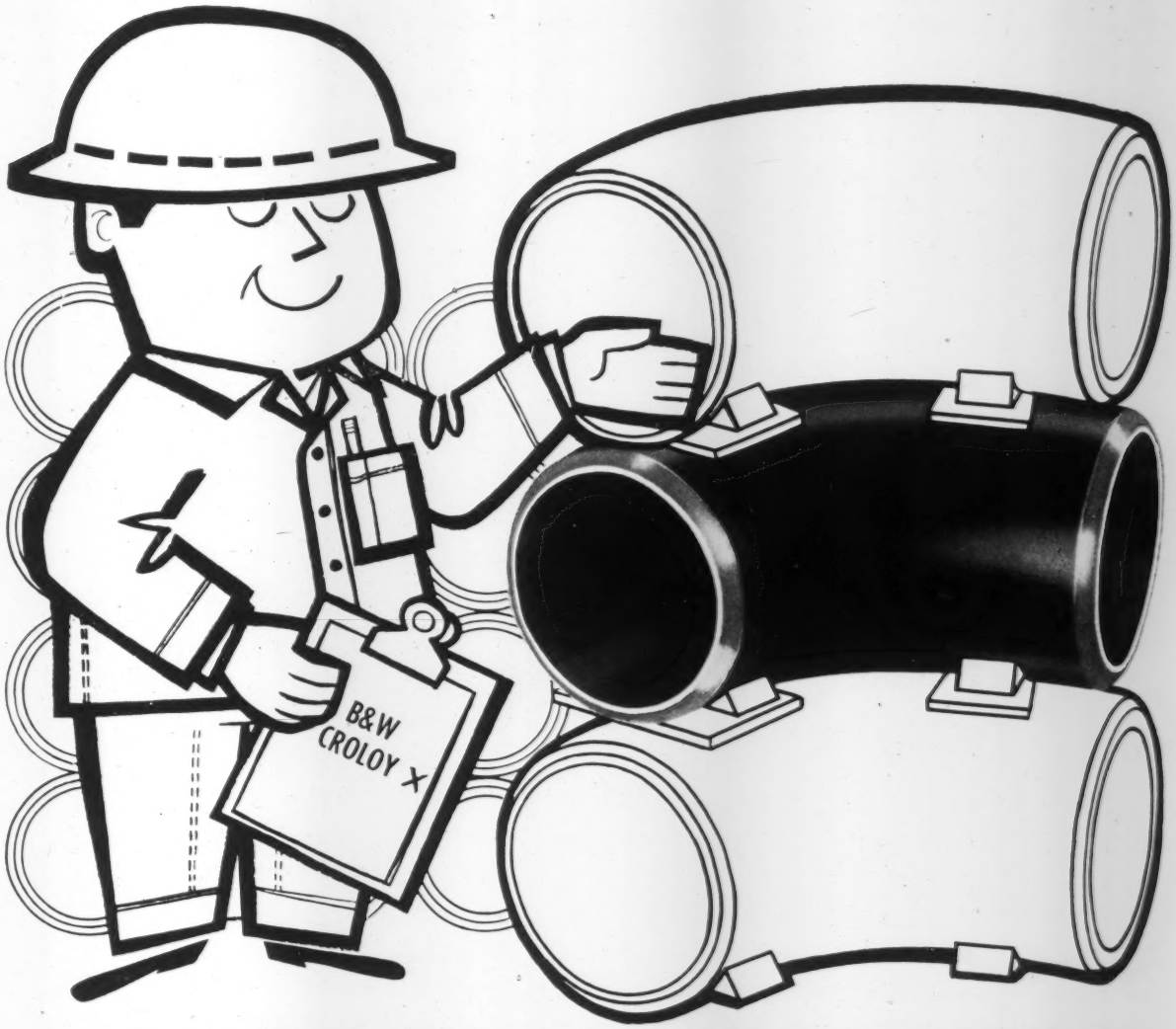
. . .for Scotch Marine boilers — *Ray Burner Co., Dept. HPAC,* 1301 *San Jose Ave., San Francisco* 12.

Automatic burner available in oil, gas and combination oil gas; capacities, in appropriate sizes, with range from 7 to 30 gph, with gas inputs from 1 to 4.2 million Btu per hr. High-low fire operation available with additional limit control.

Tube Flaring Tool . . .

. . . capable of flaring tube ends in less than 4 sec. — *Imperial Brass Mfg. Co., Dept. HPAC,* 6300 *W. Howard St., Chicago* 48, *Ill.*

Available in cone for making 45 deg flares or for making 37 deg flares; produces end flares in 6 sizes of soft copper, aluminum and brass tubing up to $\frac{5}{8}$ in. O.D. Descriptive bulletin "3088" available on request.



B&W JOB-MATCHED ALLOY FITTINGS

reduce your alloy piping problems

- You can have rapid installation and eliminate production holdups because B&W alloy steel welding fittings are dimensionally accurate and fit up fast for easy positive welding
- You get long service life because you can match the correct alloy steel to the application
- And, you get the advantage of B&W's experience in the manufacture and application of alloy steel tubular products which backs up every B&W Alloy Welding Fitting

When writing the specifications on an alloy piping job — specify B&W Job-Matched Welding Fittings. They are available in a complete range of types and sizes in carbon steel and, of course, the famous B&W CROLOYS. Call your local B&W District Sales Office or any qualified welding fittings distributor. For technical data on B&W Fittings write for the new 12-page Bulletin FB-78. The Babcock & Wilcox Company, Tubular Products Division, Fittings Department, 3839 W. Burnham Street, Milwaukee 46, Wisconsin.

B&W

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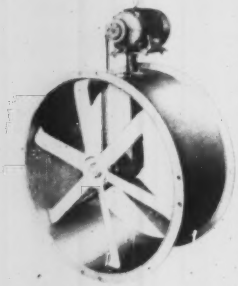
TA-9024-WF2

TUBULAR PRODUCTS DIVISION, FITTINGS DEPARTMENT

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals.

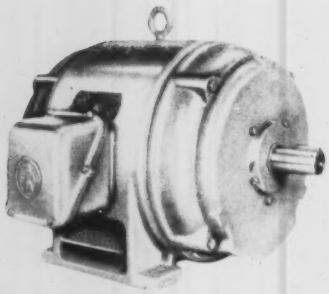
EQUIPMENT DEVELOPMENTS
Continued



Exhaust Fans . . .

. . . for exhaust hoods and oven air seals—*Binks Mfg. Co., Dept. HPAC, 3122 Carroll Ave., Chicago* 12.

Functions in temperature range from −40 to 400 F; available with single mounting ring or double flush rings; hp requirements range from ¼ to 7.5; sizes range from 18 to 42 in.; free air delivery ranges from 3180 to 29,500 cfm.



Drip-proof Motor . . .

. . . with distributed heat dissipating facilities—*Fairbanks Morse & Co., Dept. HPAC, 600 S. Michigan Ave., Chicago* 5.

Available in frames 364U to 445U; circulation of ventilating air controlled by series of integral cast baffles. Descriptive bulletin "AEL 450.1" available on request.

Roof Ventilator . . .

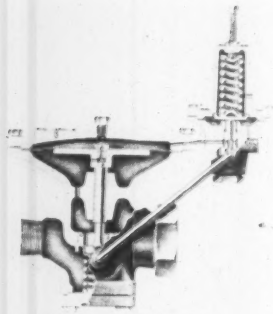
. . . with weatherproof housing—*Greenheck Fan & Vent Corp., Dept. HPAC, Schofield, Wisc.*

Designed with aluminum extrusions; air stream free of noise producing obstructions; bearing arrangement places fan wheel center of gravity between bearings.

Circulation Heaters . . .

. . . designed for water, oil, steam, and air—*Vulcan Electric Co., Dept. HPAC, 88 Holten St., Danvers, Mass.*

Heating elements in copper, steel, stainless or alloy sheath; sizes range from 5 kw to 120 kw low or medium watt densities with voltages up to 550.



Reducing Regulator . . .

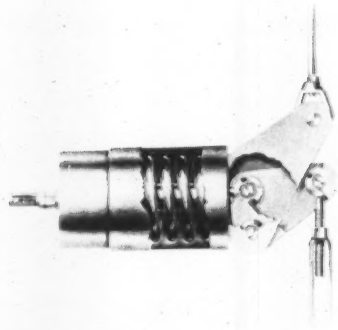
. . . for controlling steam heating pressures and for process supply—*Mason-Neilan Div., Worthington Corp., Dept. HPAC, Nahatan St., Norwood, Mass.*

Iron body construction; sizes ¾ to 2 in. screwed connections; pressure ranges are 2 to 12, 8 to 50, 25 to 150 psi.

V-Belt Drive . . .

. . . in oil, heat, and static resistant construction — *Dayton Rubber Co., Dept. HPAC, 2342 W. Riverview, Dayton, O.*

Designed with series of parallel V-ribs molded on inside circumference completely filling sheave V-grooves. Available in 3 V-rib sections: 3/32 in., 3/16 in., ⅜ in., and complete range of lengths and number of V-ribs per belt.



Pipe Hanger . . .

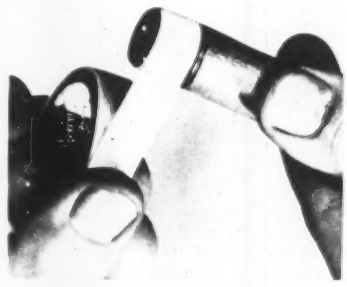
. . . producing constant supporting effect on loads traveling in vertical directions — *Fee & Mason Mfg. Co., Inc., Dept. HPAC, Manasquan, N.J.*

Designed with high safety factor to withstand occasional shocks of shipping, erection, use; offered in 4 types and variety of sizes: single and double suspension models, vertical model, junior model.

Proportioning Pump . . .

. . . featuring corrosion-resistant transparent plastic head—*B-I-F Industries, Inc., Dept. HPAC, 345 Harris Ave., Providence* 1, *R. I.*

Available in 3 models for adjustable proportioning up to 12, 24, 36 gph; discharge pressures up to 125 psi.



Pipe Joint Tape . . .

. . . for sealing threaded pipe joints —*Friesland Plastics Co., Dept. HPAC, Friesland, Wisc.*

Unaffected by temperatures from −250 to 500 F; can be used on

AUTO AIRCON STEEL CABLE V-BELTS

Forget your experiences with V-Belts on air-conditioning units

The U.S. Auto AirCon Steel Cable V-Belt has everything required in a belt for air-conditioning use. Here is a V-Belt that's in a class by itself. It is equipped with pulling members of steel. A new patented curing method and electronic tensioning of the steel cords free this belt from vibration. It transmits power smoothly, quietly and efficiently—and in present automotive air-conditioning service lasts 1½ to 2½ times longer than any other V-Belt. Here are the unequalled advantages the engineers point out:

- All steel cable members lie in the same plane.
- Wire cable members are straight, never wavy.
- Absolute uniform top width and belt thickness for better seating in pulley.
- Perfect dynamic balance.
- Use of knurled mold insert provides maximum traction and alignment of outside idler.

Our transmission belt field engineers stand ready to consult with you on any or all V-Belt problems. Drop us a line at address below. • • •

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United States Rubber

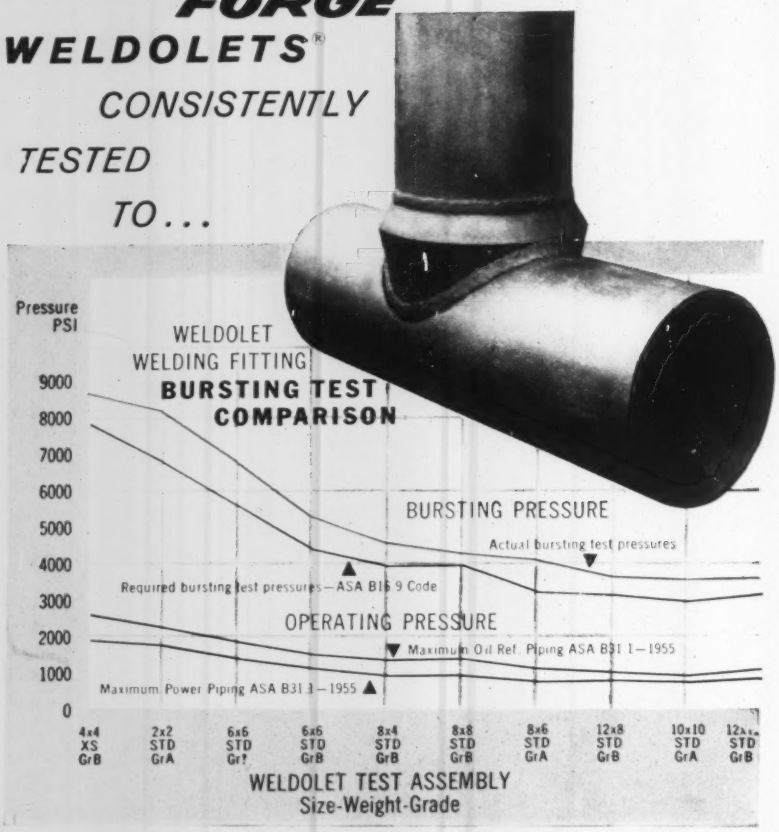
WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

BONNEY FORGE

WELDOLETS®

CONSISTENTLY TESTED TO . . .



. . . OVER 4½ TIMES MAX. OPERATING PRESSURE

"Shape of Reinforcement"—has been pioneered by Bonney for the past 20 years. The fact that shape is as important and even more important than area replacement for branch reinforcement is now gaining wide industry recognition. Even though Weldolets *do* have sufficient area replacement, the factor setting them apart from conventional lap type reinforcement is their SHAPE . . . Reinforcement close to the juncture—completely bonded homogeneous reinforcement avoiding cracks, fillet welds, and re-entrant corners—reinforcement tapering at the sides to prevent abrupt change in thickness where fitting joins header pipe.

Recent design improvements in the Weldolet line, based on extensive stress analysis tests, provide all these desirable "shape" factors. Specify and use Weldolets for all your full size and reducing branch connections. They are available in carbon steel and all alloys for any piping service.

BONNEY

WELDOLETS®
THREDOLETS®
SOCKOLETS®
ELBOLETS®
BRAZOLETS®
SWEEPOLETS®

CARBON STEEL
STAINLESS
ALLOY
for all services

BONNEY FORGE and TOOL WORKS
ALLENTOWN, PENNSYLVANIA

EQUIPMENT DEVELOPMENTS

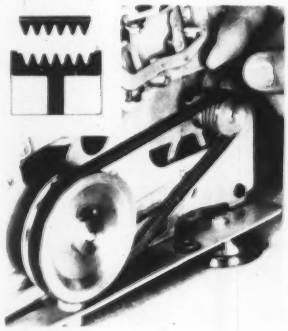
Continued

metals or non-metals; unaffected by acids, alkalies, or solvents; available in $\frac{1}{2}$, $\frac{3}{4}$, 1 in. widths in rolls of 250, 500, 1000 in.

Control Valves . . .

. . . featuring one operator—*George W. Dahl Co., Inc. Dept. HPAC, 86 Tupelo St., Bristol, R. I.*

Operator is cast aluminum utilizing 3 to 5 psi air signal, can be inverted to utilize air to open or close valve; body pressure rating is 300 psi; body temperature rating is 150 F, operator temperature rating is 180 F maximum; flow coefficient ranges from 0.002 to 13.2.



V-Belt . . .

. . . designed for high-speed, small-pulley, power transmission applications—*Raybestos-Manhattan, Inc., Dept. HPAC, 61 Willett St., Passaic, N. J.*

Operates over sheaves as small as 0.8 in. diam; pitch length range from 8 to 98 in. at speed of 10,000 fpm or rpm. Descriptive bulletin "MH42" available on request.

Creamery Package *engineers are supervising installation of a rink refrigerating system that utilizes Youngstown Continuous Weld Pipe.*

Accent on Excellence

Youngstown continuous weld pipe

Today, public ice skating is attracting larger crowds than ever before. Longer seasons result in more fun for skaters —greater profits for rink operators.

Providing all-season ice in over 80 skating and curling clubs and rinks in North America are CP refrigeration systems, designed and built by The Creamery Package Mfg. Company, of Chicago.

CP ice systems rely on quality such as Youngstown Standard and Extra Strong Black Carbon Continuous Weld Pipe for their refrigeration coils. This strong, durable pipe is ideally suited for its role, serving equally as well as wrought iron or other special analyses.

Wherever steel becomes a part of things *you* make, the high standards of Youngstown *quality*, the personal touch in Youngstown *service* will help you create products with an "accent on excellence".

Engineered Ice Rinks

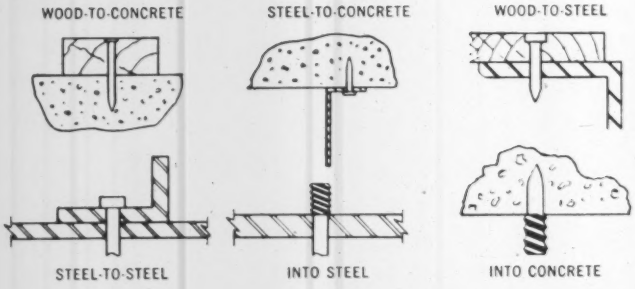
Youngstown
Youngstown, Ohio
THE YOUNGSTOWN SHEET AND TUBE COMPANY
Carbon, Alloy and Yoloy Steel

ONLY RAMSET

"covers all the bases in powder-actuated fastening"

This statement has been made by hundreds of contractors, architects, electricians, plumbers, maintenance men, supervisors, foremen and others over the past ten years! Whatever the job, if it involves fastening into concrete or steel Ramset can do it more easily, efficiently, and with a lower in-place fastener cost.

Threaded studs, drive pins, eye pins—over 100 specialized fasteners team with ten types of powder charges to assure you of just the right holding power for each job. It will pay you to get more details. Your Ramset dealer is listed in the Yellow Pages under tools . . . call him today!



In addition to powder-actuated fastening, the versatile Ramset System includes Shure-Set® hammer-in tools for light fastening, and Ringblaster® heavy-duty kiln gun.

Ramset® Fastening System

WINCHESTER-WESTERN DIV. • OLIN MATHIESON CHEMICAL CORPORATION
289 WINCHESTER AVENUE • NEW HAVEN 4, CONNECTICUT

EQUIPMENT DEVELOPMENTS

Continued

Pipe Threading Machine

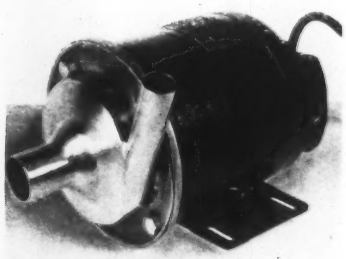
. . . featuring choice of floating type, adjustable die-heads — *Oster Mfg. Co., Dept. HPAC, 1340 E. 289th St., Wickliffe, O.*

Unit will ream, thread and cut-off pipe, bolts with ½ hp universal, geared head variable speed motor. Capacity of machine is ⅛ to 2 in. pipe, ¼ to 2 in. bolts, and 2½ to 12 in. pipe using drive shaft and geared tools.

Oxygen Analyzer . . .

. . . for measurement of low concentrations of oxygen — *Hays Corp., Dept. HPAC, 800 E. 8th St., Michigan City 14, Ind.*

Available in 3 ranges: 0 to 1 percent, 0 to 2 percent, 0 to 3 percent with accuracy ± 2 percent of range; provides response with time constant of 4 to 7 sec.; is unaffected by hydrogen concentrations up to 50 percent; sensitive to changes of 0.01 percent oxygen.



Centrifugal Pump . . .

. . . offering flexibility of application by conserving weight and space — *R. S. Corcoran Co., Dept. HPAC, P.O. Box 1404, Mound at Brandon, Joliet, Ill.*

If you design, specify, install or service heating equipment you will find these technical brochures on the control of draft an important aid.

May we send you copies?

Handbook and Installation Guide

field

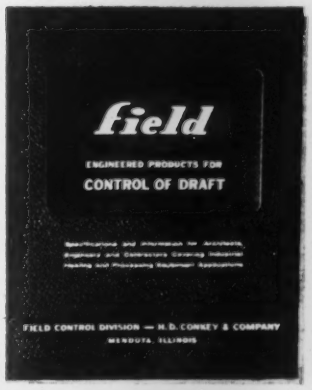
FIELD CONTROL DIVISION

H. D. Conkey & Company — Mendota, Illinois

AFFILIATES

Conco Building Products, Inc. — Brick, Tile, Stone
Conco Materials Handling Division — Cranes, Hoists
Spartan Tool Division — Sewer Cleaning Equipment

Specification Guide



The Cambridge AEROSOLVE® Filter is the RELIABLE Filter

- High Efficiency
- Positive Filtration
- Low Pressure Drop
- Easy Installation & Maintenance
- High Velocity — 450 FPM
- Expert Technical Assistance

Cambridge AEROSOLVE Filters do not depend on electric power — there is no chance of failure — no chance of break-through. The more loaded with dirt they become, the more efficient they become. This is really *Positive Filtration* — Safe, dependable!

Available in choice of three interchangeable cartridges of 95%, 85% and 35% efficiency, discoloration test with atmospheric dust.

Write for Bulletin 132

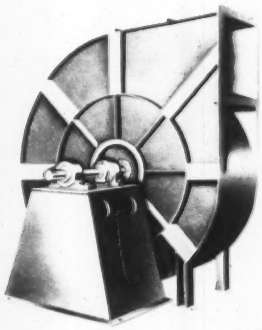
Cambridge Filter Corporation
732 E. Erie Blvd., Syracuse 1, N. Y.

Pioneers in High Efficiency Air Cleaning

REPRESENTATIVES IN PRINCIPAL CITIES

EQUIPMENT DEVELOPMENTS
Continued

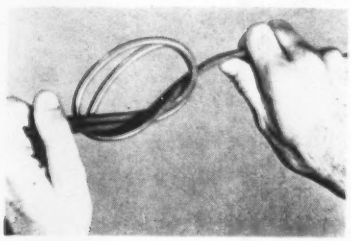
Entire pump assembly resistant to corrosion, made of brass, Monel, stainless steel; casing is 7 in. in diam and 3 to 3½ in. deep. Pump and 1/3 hp motor combination weigh 20 lb.



Pressure Blowers . . .

. . . for steel mill furnaces, product cooling, pressure or vacuum drying, liquid agitation — *Westinghouse Electric Corp., Sturtevant Div., Dept. HPAC, 200 Readville St., Hyde Park, Boston 36, Mass.*

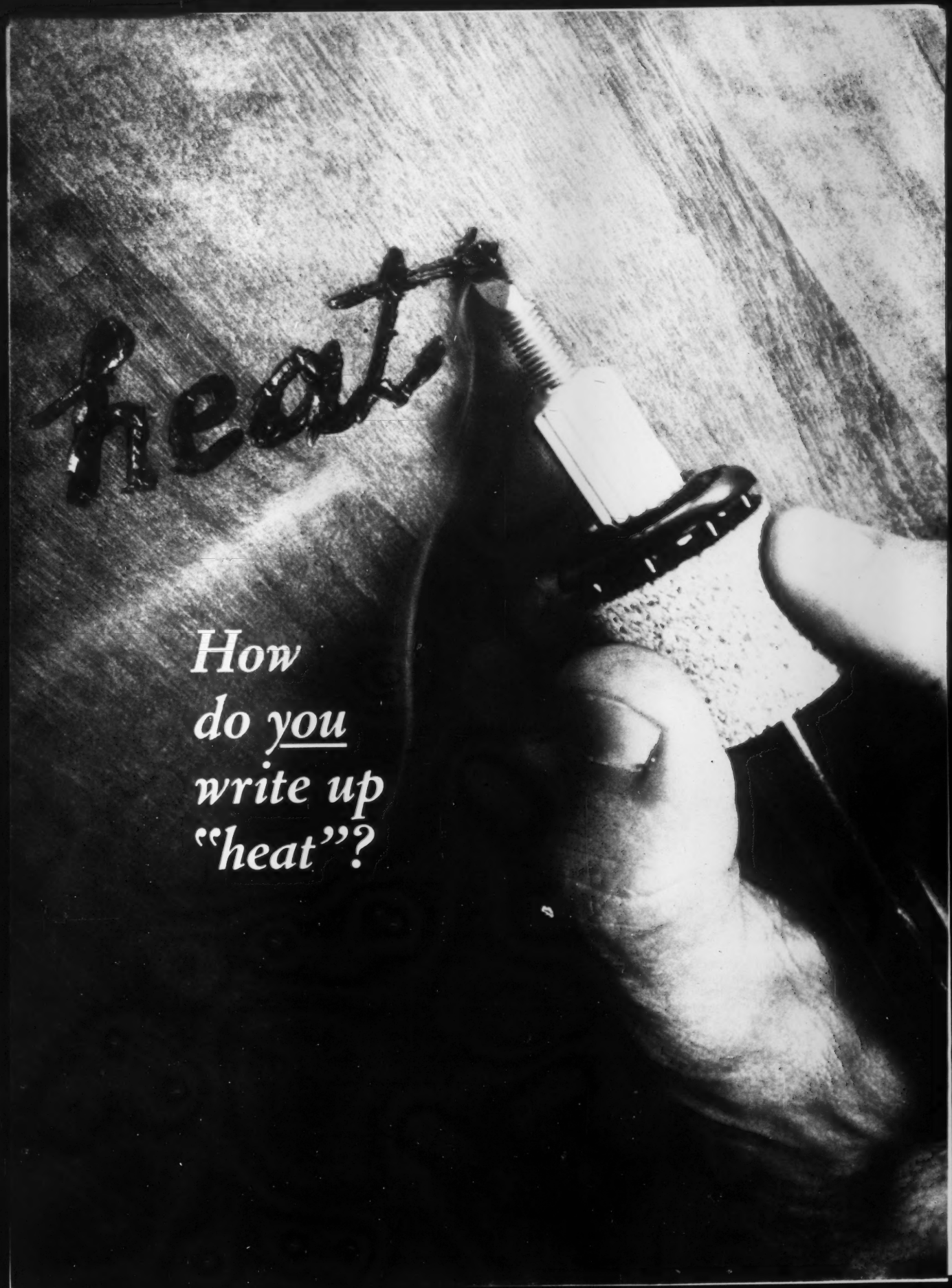
Aerodynamic flow passages through wheel and housing give optimum performance with minimum power input of new line which has 3000 to 64,000 cfm at pressures from ¾ to 2¼ psig.

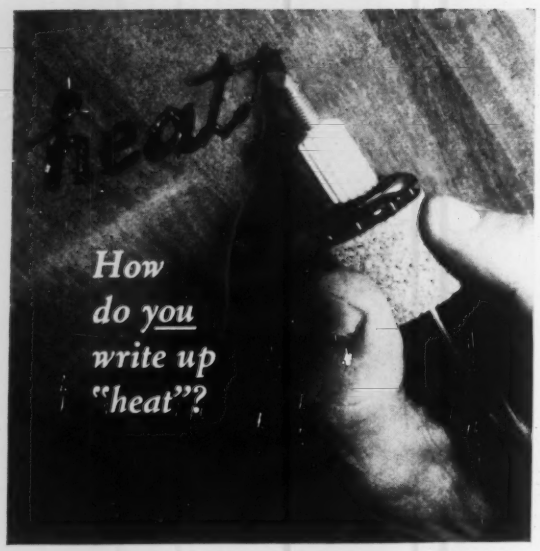


Air Hose . . .

. . . for use with portable air-operated tools — *Synflex Products, Samuel Moore & Co., Dept. HPAC, Mantua, O.*

Is impervious to oils, chemicals, has tolerances of +.005 in. with safety factor in excess of 13:1. Comes in 3/16, ¼, 5/16, ⅜ in. ID sizes each in 500 ft lengths.


heat
How
do you
write up
"heat"?



When it's *electric heat*

You can simplify your next electric heat job when you look to Ilg.

In the first place, you have a choice of electric units broad enough to cover almost every *type* of installation . . . every *capacity* need. Radiant baseboard, wall insert

Here's why ILG *electric let you*

Finishing Touch. Ilg Radiant Baseboards—in 2', 5' and 8' lengths for surface or semi-recessed mountings—are simple to install. Back panel with heating element attached either nails or screws to studding. Cover panel, end covers and corner pieces snap on by hand. Easy to paint to match any decor. Provide clean, quiet, even heat along outside walls.

At Her Finger Tips. Ilg fan-driven electric wall insert heaters pack tremendous heating output into small space. Finned heating elements deliver up to 13,648 B.t.u./hr. Separate "on-off" switch sets heater in automatic operation without disturbing comfort level of thermostatic setting. Thermostat has own selector dial—operates within 55-85° range, cannot cause radio or TV interference.

For electric heat units built to satisfy your "specs"...

you're right when you write in ILG

heaters, fan-operated unit heaters, cabinet heaters—they're all in the Ilg line.

And for your convenience in specifying, Ilg offers a new Electric Heat Manual—a handy, easy-to-use source of factual information that covers the entire line, that simplifies all calculations, that shows how to install all Ilg electric heat units, that lists detailed specifications.

For your free copy of this time- and trouble-saving reference, write for Ilg's new Electric Heat Manual.

heat units

lay out any installation

Pick Your Capacity. Ilg electric unit heaters range in size from 1½ to 36 kw. All heaters have non-glowing, steel-sheathed, black-heat type replaceable heating elements . . . superquiet Ilg "Q"-type aluminum fan wheel direct-connected to permanently lubricated motors. Choice of automatic or manual controls. Capacities from 5118 to 122,832 B.t.u./hr. Complete units bear Ilg famous "One-Name-Plate" guarantee.

Name Your Mounting. New Ilg electric cabinet heaters have 2- and 3-speed blow-through or draw-through centrifugal fans —for floor, ceiling, wall or inverted mountings. Finned strip heating elements. High-limit cutout guards against overheating. Permanent or renewable filters. Choice of manual, pneumatic or automatic electric controls. Capacities 3.33 to 30.0 kw.

specify ILG

ILG ELECTRIC VENTILATING COMPANY

2826 N. Pulaski Road, Chicago 41, Illinois

Offices in 57 Principal Cities

Member of Air Moving and Conditioning Association, Inc. (AMCA)

Weinman Type AC Unipumps can't be beat for circulating water through condensers, chillers, evaporative condensers, direct cooling units and over cooling towers.

They're designed in compact size and with versatile mounting features to ease installation in tight, hard-to-reach places. Weinman AC pumps work in any position . . . you can mount them on the floor, ceiling or wall, with the shaft horizontal, vertical or at an angle.

You can order Weinman air conditioning pumps with output ratings up to 260 g.p.m., heads up to 150'. Available in horsepower ratings from ¼ to 7½. For complete information, see your Weinman centrifugal pump specialist, he's listed in the Yellow Pages. Or, write us direct.

50th Anniversary 1909-1959

CENTRIFUGAL SPECIALISTS

THE **WEINMAN PUMP** MFG. CO.

290 SPRUCE ST. COLUMBUS 8, OHIO

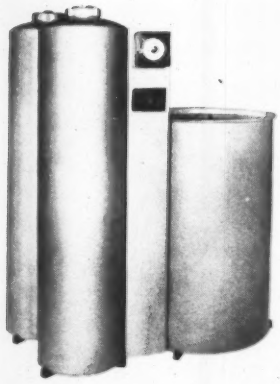
EQUIPMENT DEVELOPMENTS

Continued

Tempering Valve . . .

. . .for use on tankless heaters or storage tanks—*A. W. Cash Valve Mfg. Corp., Dept. HPAC, 666 E. Wabash, Decatur, Ill.*

Temperature adjustment range from 110 to 180 F; for use on water heaters supplying 180 F water; made of brass and stainless steel. Bulletin "5-C-8" available on request.



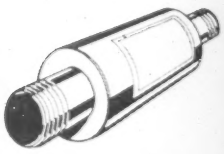
Water Conditioning Units

. . .provide automatic soft water — *Water Refining Co., Dept. HPAC, 104 Manhattan St., Middletown, O.*

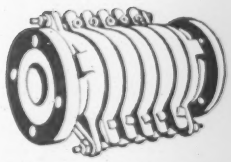
Available in capacities from 30 to 180 gpm at 40 psi; units can produce 10,800 gph. Unit features five cycle valve with three moving parts and floats. Requires 10 sq ft floor area. Descriptive illustrative bulletin available.

Cooling Coil Cleaner . . .

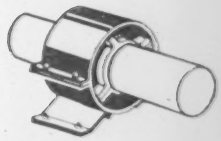
. . .designed to restore heat transfer in air conditioning systems — *Lester Laboratories, Inc., Dept. HPAC, P. O. Box 1897, Atlanta 2, Ga.*



FLEXONICS Model H Expansion Compensator —in sizes to 3", for pressures to 175 p.s.i., absorb 2" total pipe motion at each unit.



FLEXONICS Expansion Joints — controlled-flexing, free-flexing, and many special types, in an unlimited range of sizes.



FLEXONICS Pipe Guides—a completely new and better way to keep pipe in alignment. Positive, rugged, inexpensive.

FLEXONICS Model L Expansion Compensator—the sure, low-cost way to take up pipe and tubing expansion in baseboard heating systems.

INSTALL IT...
FORGET IT!

ENGINEERS ACROSS THE COUNTRY ARE SPECIFYING FLEXONICS MODEL L PACKLESS EXPANSION COMPENSATORS

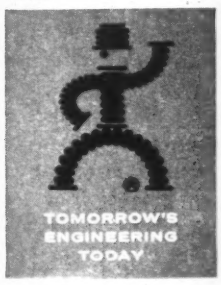
You'll find FLEXONICS Model L Expansion Compensators written into the heating specifications for the finest, most modern buildings across the country. There's no substitute for their completely packless design, their easy installation, and the fact that they *never need maintenance!*

There's no easier or lower-cost way to take care of pipe and tubing expansion and eliminate water hammer noise, especially in baseboard convector installations. Install a FLEXONICS Expansion Compensator in minutes — forget it for the life of the building.

They have been proved in thousands of installations. Why not write them into your next job? Write today for cost data, and the name of your FLEXONICS representative.

Today—write for informative and helpful Catalog

EC-135



Flexonics

EXPANSION COMPENSATORS

FLEXONICS CORPORATION • 1391 SOUTH THIRD AVENUE • MAYWOOD, ILLINOIS

Divisions

INDUSTRIAL HOSE • EXPANSION JOINT • BELLOWS • AERONAUTICAL • AUTOMOTIVE

Flexonics Research Laboratories, Elgin, Illinois

In Canada: Flexonics Corporation of Canada, Limited, Brampton, Ontario

Cut Steel or Cast Iron Pipe up to 12" EASIER and FASTER

WITH THE NEW REED

HINGED 4-WHEEL
PIPE CUTTER

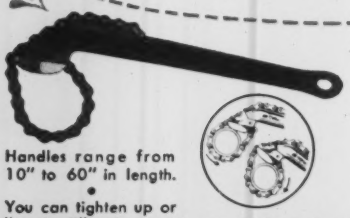
- Closed Frame Construction assures complete rigidity with less weight.
- 4-Wheel design needs minimum swing of handle.
- 4-Point pipe guide aligns cutter for perfect tracking of wheels and a right angle cut.
- Quickly interchangeable wheels for steel or cast iron.
- Needs only 3" space to pass under 12" pipe.

For ditch work or similar close-quarter operations these new Reed Cutters are practically indispensable and fully justify replacing whatever cutting equipment you are now using.

You can, for example, cut 8" steel pipe in less than five minutes, and cast iron pipe even faster.

Available in five sizes for steel or cast iron pipe from 1" to 12".

FOR FAST TURNING IN TIGHT SPOTS—
USE THE IMPROVED REED CHAIN WRENCH



Handles range from 10" to 60" in length.

•

You can tighten up or "back off" without taking wrench from pipe.

These improved chain wrenches will do anything an ordinary pipe wrench will do . . . and do it easier, better and faster. Ideal for ditches or tight corners.

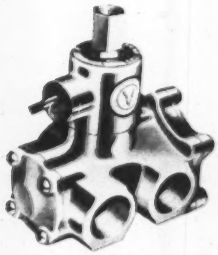
Grip securely with no play, yet they have a ratchet-like action.

REED MANUFACTURING COMPANY
ERIE • PENNSYLVANIA

EQUIPMENT DEVELOPMENTS

Continued

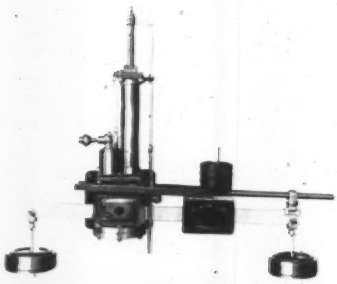
New liquid concentrate is blend of synthetic penetrants, is non-toxic, non-inflammable, non-corrosive, odorless. Requires 15 min to clean large coil bank, 2 to 3 min to clean 20 in. × 24 in. filters.



Solenoid Valves . . .

. . . to control oil, air, water, inert gases, kerosene, and gasoline — *Skinner Electric Valve Div., Dept. HPAC, 105 Edgewood Ave., New Britian, Conn.*

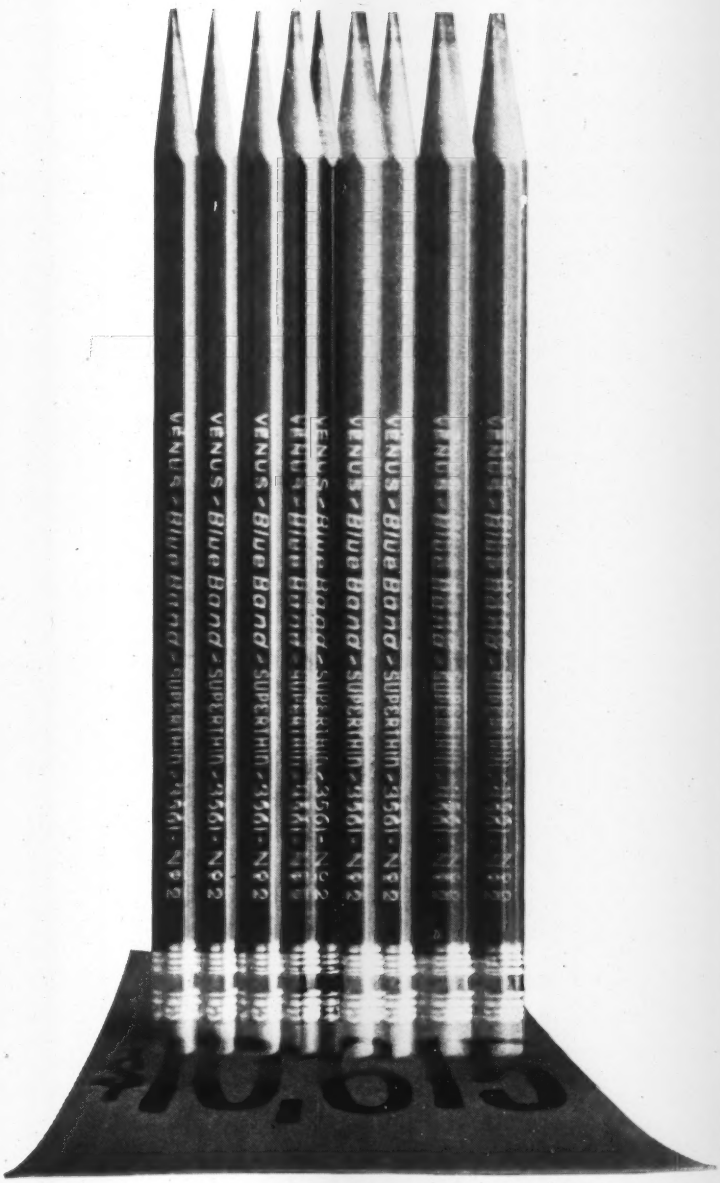
Valves mount in any position directly to line and operator on pressure defferential of 5 to 150 psi. Comes in $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ in. sizes. Bodies are of naval forged brass and internal parts of stainless steel and brass. Descriptive literature available on request.



Damper Regulator . . .

. . . for fans, stokers, oil and gas control valves — *Atlas Valve Co., Dept. HPAC, 280 South St., Newark 5, N.J.*

Suitable for use on boilers operating at pressures from 5 to 150 psi with adjustments made by adding or removing weights from lever of regulator. Regulator will move damper or pressure changes of $\frac{1}{4}$ psi.



Climate by Chrysler

erases $10,615 a year off the cost of erasers for Venus Pen & Pencil

Venus Pen & Pencil Corp. now produces better erasers—and saves $10,615 a year besides—by using a Chrysler Liquid Chiller to supply cool water for the rolls used in calendering the rubber.

The rolls must be kept from overheating to prevent discoloration or damage to the rubber. Venus Pen & Pencil had been using city water in its Lewisburg, Tenn., rubber plant. Water costs ran nearly a penny per pound of processed rubber. And, since water temperature rose too high in summer, 10% of its production was wasted.

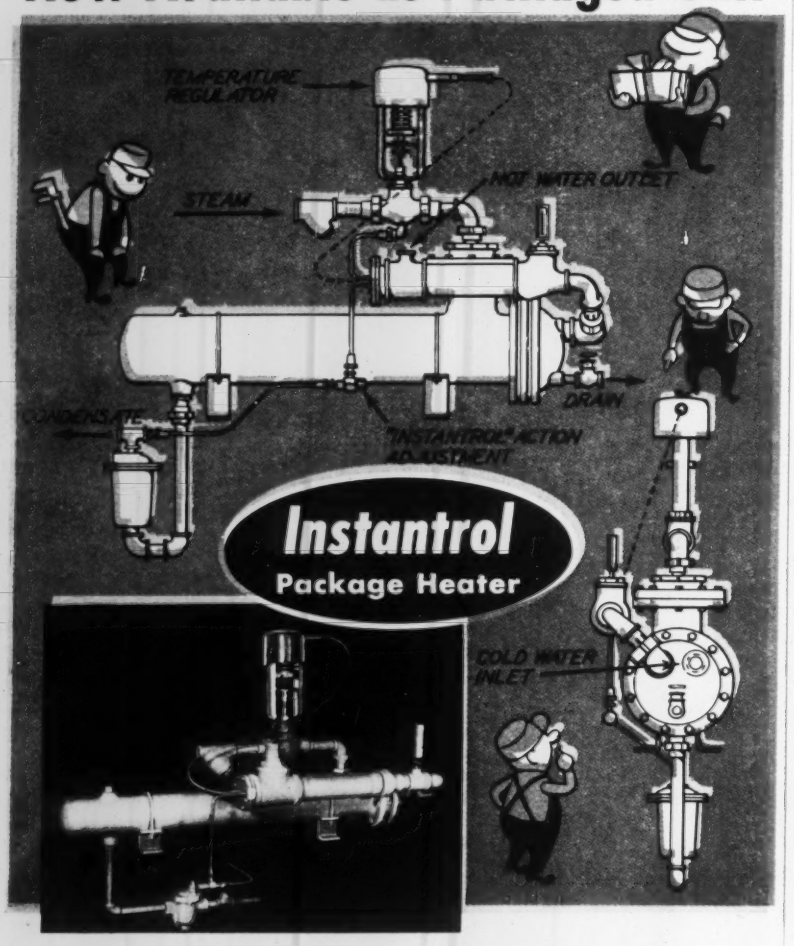
The Chrysler Liquid Chiller solved the production problem by keeping recirculated water at a constant 50° F. Eraser quality improved . . . and $9,000 worth of waste rubber per year was eliminated. Water costs were cut almost 75%—saving $3,550 annually. And maintenance costs on the rolls dropped $500. Net savings of $10,615 in the first year practically paid the entire cost of the Chrysler Liquid Chiller installation.

Where chilled water is required for cooling a process, or cooling for comfort, Chrysler equipment offers many exclusive advantages: Hermetically sealed Radial Compressor, innerfin direct expansion chiller, lower installation and maintenance costs. Get the complete story and technical data from your local Chrysler Applied Machinery and Systems sales office. Or write: Airtemp Division, Chrysler Corp., Dept. Y-92, Dayton 1, Ohio. In Canada: Therm-O-Rite Products, Ltd., Toronto, Ontario.

CHRYSLER AIRTEMP

FIRST WITH THE FINEST IN AIR CONDITIONING

Controlled Instantaneous Heater Now Available as Packaged Unit



Control heated liquids accurately — regardless of load — with this new "package." All the small space, low-cost advantages of instantaneous heaters PLUS the accuracy needed for hot water supply in wash rooms, shower rooms and for industrial liquid heating! Patented "Instantrol" bulb provides "heat anticipating" effect for complete control under varying loads — and a single-seated, tight-closing regulator valve prevents temperature build-up on long standby periods!

Complete "package" includes heater, regulator and Instantrol bulb, steam strainer, mechanical steam trap, discharge thermometer and necessary fittings . . . assembled and pre-tested, ready for operation after on-job connections.

Write for Bulletin RH-111

Mr. Controls

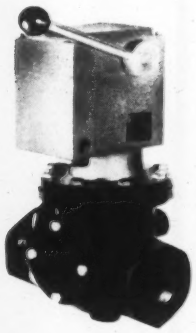
Robertshaw-Fulton

CONTROLS COMPANY

FULTON SYLPHON DIVISION • Knoxville 1, Tennessee

EQUIPMENT DEVELOPMENTS

Continued



Gas Valve . . .

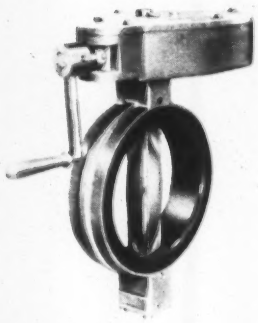
. . . with increased safety features—*General Controls, Inc., Dept. HPAC, 801 Allen, Glendale, Calif.*

Utilizes straight-through, non-turbulent flow with fast acting shut-off, according to manufacturer. Two types available: manually reset and electrically reset; for pipe sizes from 1 to 6 in.; gas capacities up to 54,000 cfh at 1 in. WG pressure drop.

Seamless Aluminum Tube

. . . made from 3003-0 aluminum alloy in soft temper — *Chase Brass & Copper Co., Dept. HPAC, Waterbury 20, Conn.*

Sizes range from $\frac{1}{8}$ in. OD with wall thickness of 0.025 in. has bursting pressure of 1066 psi. Tube $\frac{3}{4}$ in. OD with wall thickness of 0.049 in. has bursting pressure of 348 psi.



Butterfly Valve . . .

. . . with wide range of material trim and valve actuators—*Henry Pratt Co., Dept. HPAC, 319 W. Van Buren St., Chicago 7.*

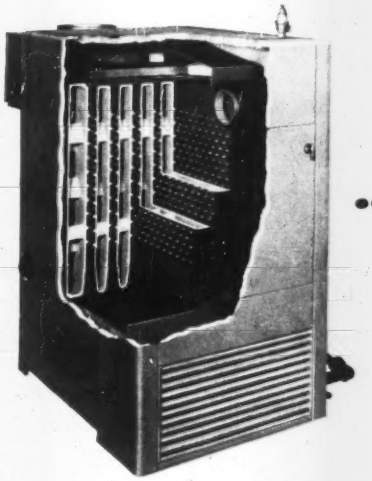
Oak Park School,
Laurel, Mississippi

SUPERINTENDENT OF SCHOOLS: J. M. Caughman.

ARCHITECT-ENGINEERS: John L. Turner & Associates, Jackson, Miss.

HEATING CONTRACTOR: McCaskill Brothers Plumbing & Heating, Laurel, Miss.

DISTRIBUTOR: Gene Arledge Company, Jackson, Miss



MODERN SCHOOL ...MODERN BOILERS

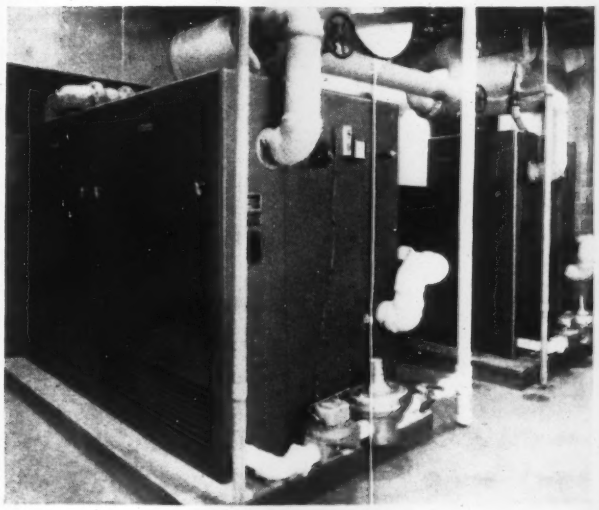
In selecting Weil-McLain Type "J" Gas Boilers for this school, the multiple advantages of the modern cast iron boiler received full recognition. Two J-21 boilers supply heat to both wings of the school and to the adjoining gymnasium. The sectional construction of these boilers is a particularly valuable feature as it permits easy adding of capacity in the event of school expansion.

There are numerous other specific reasons why Weil-McLain Type "J" Boilers offer the utmost in long-lived, dependable and economical heating—

Type "J" Boilers are available in these net I=B=R capacities:
Hot Water, 375,100—3,105,600 BTU/hr.
Steam, 1,565—12,940 sq. ft.

1. Made of corrosion-resistant cast iron.
2. A.G.A. approved minimum efficiency of 80%.
3. Develop full capacity as rated by I=B=R.
4. Compact design saves space—up to 40%.
5. A.G.A. approved for all gases.
6. Available with A.G.A. approved dual fuel manifold.
7. Electronic controls available as engineered part of unit.
8. Only a vent needed to carry off products of combustion.
9. Lower maintenance—easily cleaned, no refractories, no motors, no fans, no tube replacement, no water treatment.
10. Can be assembled at any stage of building construction. Sections pass through ordinary door.
11. Wide range of capacities permits accurate sizing.

Write today for complete information or see listing in Sweet's Architectural File or Engineers' Product File.



WEIL-McLAIN

TYPE "J" CAST IRON GAS BOILERS

WEIL-McLAIN BOILERS · RADIATORS

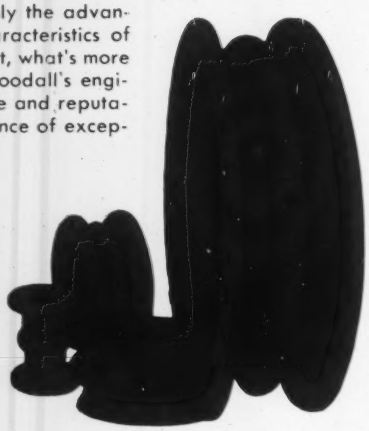
WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. AA-99.

Four Good Reasons For Installing

GOODALL RUBBER EXPANSION JOINTS

Goodall Expansion Joints have not only the advantages stemming from the natural characteristics of rubber for all types of installations, but, what's more important, they have back of them Goodall's engineering skill, manufacturing experience and reputation for quality that give added assurance of exceptional service under all conditions.



EASIER TO INSTALL...

Goodall Rubber Expansion Joints are quickly, easily installed on new construction or as replacements. They are light in weight to facilitate handling, with short face-to-face dimensions for easier application where space is limited. Retaining rings are quickly aligned and bolted. No gaskets are required.

RESPONSIVE TO MINIMUM PRESSURE...

With Goodall Rubber Expansion Joints only the slightest pressure is required to create movement in any direction. Result—stress on metal pipe or other member is eliminated or, at most, reduced to an absolute minimum.

MANY SIZES...HIGH WORKING PRESSURES...

Goodall Rubber Expansion Joints are available in sizes from 3/8" to 96" I.D., in all required styles and constructions. Working pressures range up to 125 P.S.I. for Pressure Joints, and to 90 P.S.I. for Vacuum-Pressure Joints, depending on size.

LONGER SERVICE LIFE...

Goodall Rubber Expansion Joints last longer in service because of inherent characteristics of the material from which they are made. There is no embrittlement... continuous movement (flexing) actually keeps the rubber joint "alive". There is no corrosion or electrolysis. Resistance to abrasion is exceptionally high. Replacement costs are lower.

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Contact Our Nearest Branch or Write for Catalog

Standard of Quality—Since 1870

HOSE · BELTING · FOOTWEAR · CLOTHING
AND OTHER INDUSTRIAL RUBBER PRODUCTS

GOODALL *Rubber Company*

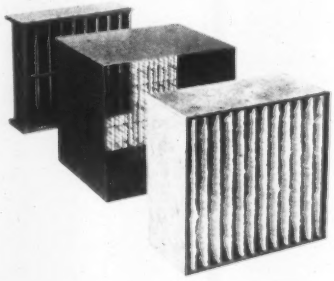
GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES.
IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.

EQUIPMENT DEVELOPMENTS

Continued

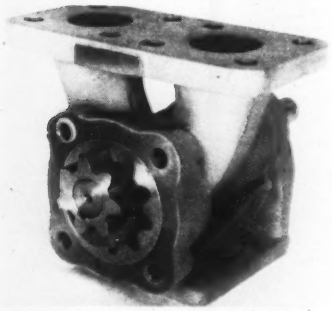
Offered for 150 psi tight shutoff in sizes 4 through 20 in. Bulletin "10-DG" available on request.



Filter Frame . . .

. . . to simplify filter installation—*Cambridge Filter Corp., Dept. HPAC, 738 E. Erie Blvd., Syracuse 1, N.Y.*

Upstream portion holds standard 12 in. filter cartridge; downstream end designed for activated charcoal filter; complete unit has 1000 cfm capacity, dimensions are 24 × 24 × 21 in.



Rotary Pumps . . .

. . . for diesel and heating oils, kerosene, varnishes, tar, asphalt, coolants — *Stig Nyberg, Dept. HPAC, 33 Redfield St., Rye, N.Y.*

Comes in seven sizes with capacities from 0.8 to 12 gpm at 210 psi and 1240 rpm; 12 to 106 gpm at 140 psi and 1240 rpm. Descriptive folder available on request.

Electric Boiler . . .

. . . designed for radiant panels, convectors, baseboards and radiators — *Precision Parts Corp., Dept. HPAC, 100 N. First St., Nashville 7, Tenn.*

NEW IMPROVED

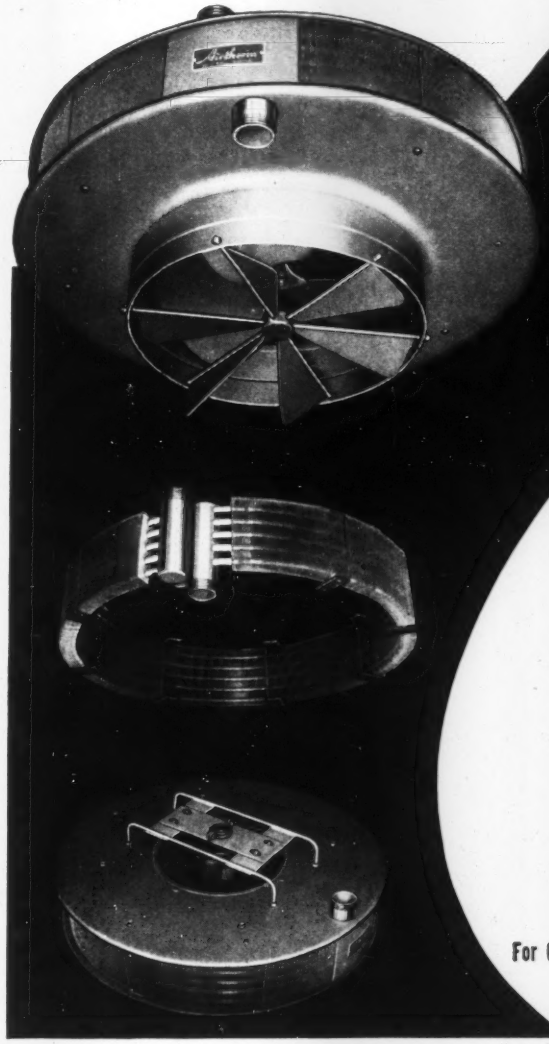
Airtherm

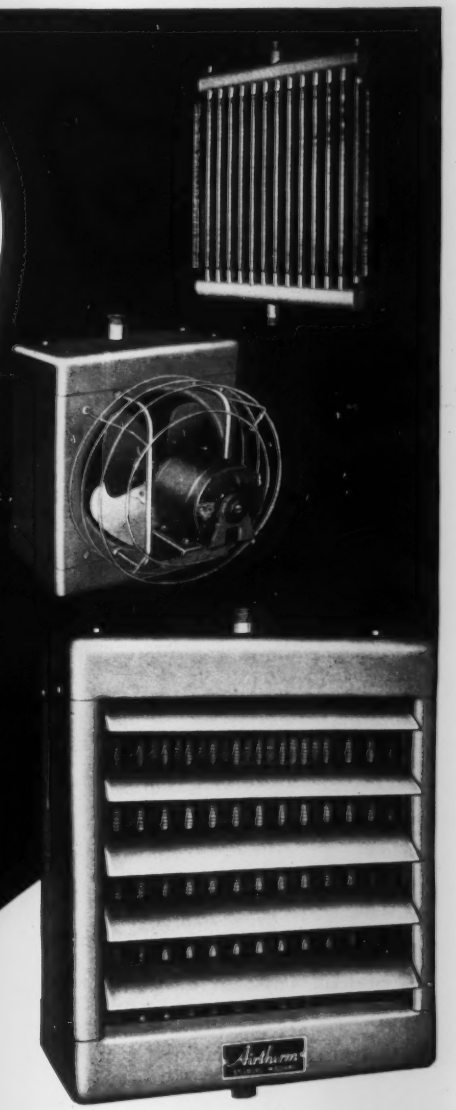
PROPELLER FAN

UNIT HEATERS

FOR STEAM OR HOT WATER

A SIZE FOR EVERY REQUIREMENT





The new Airtherm line incorporates 22 completely redesigned vertical units and 24 improved horizontal units, ranging from 18,000 to 555,000 BTU per hour, with a choice of outlet diffusers to cover practically every air distribution pattern and mounting height. Silent operation is assured by resiliently mounted motors, properly designed fans and casings, and attention to face and outlet velocities. All fans are expertly positioned, balanced and tested. Each unit is tested and rated for performance in strict accordance with the Standard Test Code of the industry. Only brand name, continuous duty motors, especially made for the purpose, are used and mountings are designed for efficient cooling and easy servicing. Rugged coils are formed by hydraulically expanding copper tubing into plate type aluminum fins, each with its own collar, providing increased heat transfer and wide, even spacing to reduce clogging. All coils are tested and tagged for 500 p.s.i. hydrostatic pressure. Casings are phosphatized to insure a long, rust-free life for the attractive baked enamel hammer tone finish.

For Complete Specifications Including a Guide for Selection and Application, Write:

AIRTHERM MANUFACTURING CO.

702 S. SPRING AVE. • ST. LOUIS 10, MO.

Things to Think About in Selecting Sidewall Diffusers

...aspiration, aspect ratio, noise levels, smudging, and other factors

A sidewall diffuser has three basic functions to perform:

1. Attractively cover the duct opening in the wall.
2. Impart direction to air flow.
3. Diffuse the conditioned air thoroughly and rapidly before it reaches the occupancy zone.

If a "diffuser" doesn't truly diffuse, it can drop a solid mass of cold air onto occupants of the room. One way to get around this problem is to direct the air flow from the diffuser toward an unoccupied area of the room. Another method is to use ceiling diffusers even when sidewall diffusers would be easier and more economical to install. Neither solution is ideal.

The Answer

Barber-Colman Uni-Flo sidewall diffusers provide an efficient answer to the problem. They provide very thorough aspiration. A turbulence is created which keeps the cooled air above the occupancy zone for the full length of throw. Conditioned air literally "trickles" into the room. Rapid warmup is secured. There is no mass of cold air to disturb human comfort.

The requirements outlined in this quote are from Heating, Ventilating, Air Conditioning Guide, '58, chap. 30:

"The air discharged from a wall outlet should not reach the occupied zone until the velocity has fallen to about 50 fpm. Therefore, the outlets should be located high enough for the air stream at the termination of throw to be not less than five or six feet above floor level. Or, in other words, the drop should not be more than the difference between mounting height and zone of occupancy."

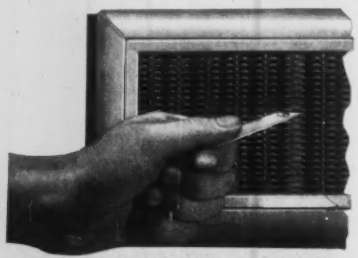


Fig. 2 Barber-Colman Uni-Flo Sidewall Diffuser — Note grille design which creates controlled air turbulence for complete aspiration.

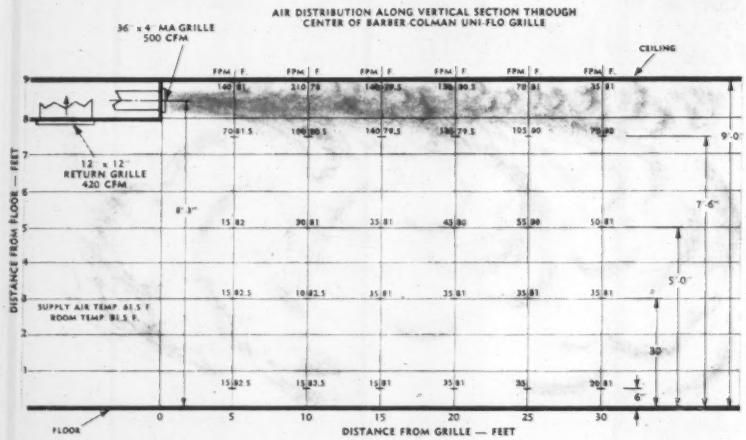

AIR DISTRIBUTION ALONG VERTICAL SECTION THROUGH CENTER OF BARBER-COLMAN UNI-FLO GRILLE
36" x 4" MA GRILLE 500 CFM
CEILING
12" x 12" RETURN GRILLE 420 CFM
SUPPLY AIR TEMP. 61.5 F
ROOM TEMP. 81.5 F.
DISTANCE FROM FLOOR — FEET
DISTANCE FROM GRILLE — FEET
FLOOR

Fig. 1 Uni-Flo Grille Traverse — This charts the results you can predict and deliver with Uni-Flo grilles. Only Uni-Flo grilles are true sidewall diffusers guaranteed to perform in accordance with the published data.

It is almost impossible to meet this requirement in a low-ceilinged (9 ft) room without the aspiration provided by Barber-Colman Uni-Flo sidewall diffusers.

Fig. 2 shows how the grille of the Barber-Colman Uni-Flo sidewall diffuser is designed to create air turbulence. This is in direct contradiction to the theory of using "air foil" sections (which create a laminar flow which tends to defeat aspiration and to drop air into the occupancy zone as discussed above).

There is another very nice feature about the Uni-Flo grille design. Not only does it provide for adjustment of horizontal flow, it also provides controlled adjustment in vertical planes. This permits you to steer the air past any obstacles in front of the grille.

Noise Levels

The effect upon noise level of the air turbulence created by Uni-Flo sidewall diffusers is sometimes asked about. Page 7 of Barber-Colman "Grille Engineering Data" contains a listing of noise levels for various air patterns. These figures speak for themselves, showing that there is no noise problem. Incidentally, Barber-Colman offers the most complete diffuser noise level data available, including the effect of dampers in various positions.

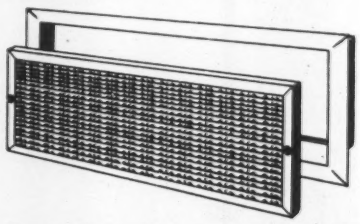


Fig. 4 Removable cores — to simplify installation and maintenance and contribute to good housekeeping.

Aspect Ratio

The aspect ratio of Uni-Flo grilles has a very definite effect on their performance, even though aspect ratio may not matter with other types of diffusers. It assists the excellent aspiration achieved by Uni-Flo diffusers and, therefore, assures more even air distribution throughout the room.

Another feature of Uni-Flo grilles is the removable core which contributes to good housekeeping. The core can be removed without damaging the paint seal around the frame. Also, electroplated cores are available (in

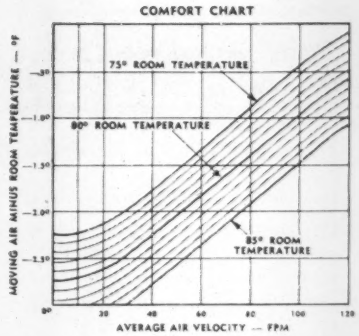


Fig. 3 Barber-Colman Comfort Chart — Here are the conditions of air movement and temperature in the occupancy zone that are required for human comfort standards. All points below the line represent uncomfortable conditions, while those above the line fulfill the requirements. You get required performance with Barber-Colman Uni-Flo sidewall diffusers.

which case the frames are painted to match the wall). Electroplated cores are less conspicuous and more durable and can be easily cleaned.

Accessories

Simple, positive, tamperproof adjustment of the air volume for easy system balancing is provided by the optional Uni-Flo opposed-blade volume control. Although normally key-operated, this can be furnished with an operating knob. Its opposed-blade design prevents any shifting in the damper setting. Deflectrols — factory-assembled deflecting vanes — attached to the rear of the diffuser provide uniform distribution across the diffuser face.

Performance

Barber-Colman diffusers will meet the following specification:

Sidewall and/or ceiling air distribution grilles and diffusers will diffuse air uniformly throughout the conditioned space, but at no point in the occupancy zone will the air velocity exceed 30 fpm at a temperature more than 2° F below the average room temperature or 75 fpm at a temperature more than 1½° F below the average room temperature.

Engineering Data Catalog No. F-4051-2 gives complete information, including 50 pages of selection data which provides all of the information necessary for even the most difficult jobs. Call your local Barber-Colman office or write to:

BARBER COLMAN

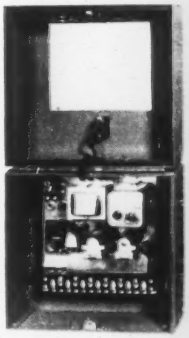
BARBER-COLMAN COMPANY

Dept. U, 1101 Rock Street, Rockford, Illinois

EQUIPMENT DEVELOPMENTS

Continued

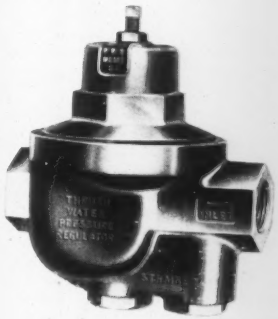
Unit supplies hot water at temperatures from 60 to 200 F, can be used with water chiller for year-round air conditioning, available in sizes from 40,948 to 2,047,200 Btu per hr output.



Combustion Safeguard . . .

. . . for supervision of gas-operated burners—*Protection Controls, Inc., Dept. HPAC, 6000 N. Legett Ave., Chicago 46.*

Prevents fires or explosions from build-up of combustible fuel mixtures in either single or multi-burner installations; plug-in assembly contains entire electronic circuit.



Pressure Regulating Valve

. . . to control high or fluctuating inlet pressures — *H. A. Thrush & Co., Dept. HPAC, Peru, Ind.*

Can be used on initial pressures up to 250 psi and delivers up to 100 psi. Comes in sizes of ½ in., ¾ in., or 1 in. in cast iron or bronze. Descriptive literature available on request.

PARAGON'S 7000 SERIES

- 4 pole versatility
- 40 ampere capacity

As many as four different voltages may be controlled through a single 7000 Series Time switch. And its 40 ampere design gives it the largest load carrying capacity of any 7-day time control.

Besides having the days clearly separated from each other, the 7000 Series has distinctly divided day and night periods. Any electrically controlled system can be turned ON and OFF automatically at different hours of each day . . . and any day or days can be omitted.

MAIL THIS COUPON FOR COMPLETE DETAILS!

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1811 Twelfth Street, Two Rivers, Wisconsin
Send full information on the new 7000 Series.
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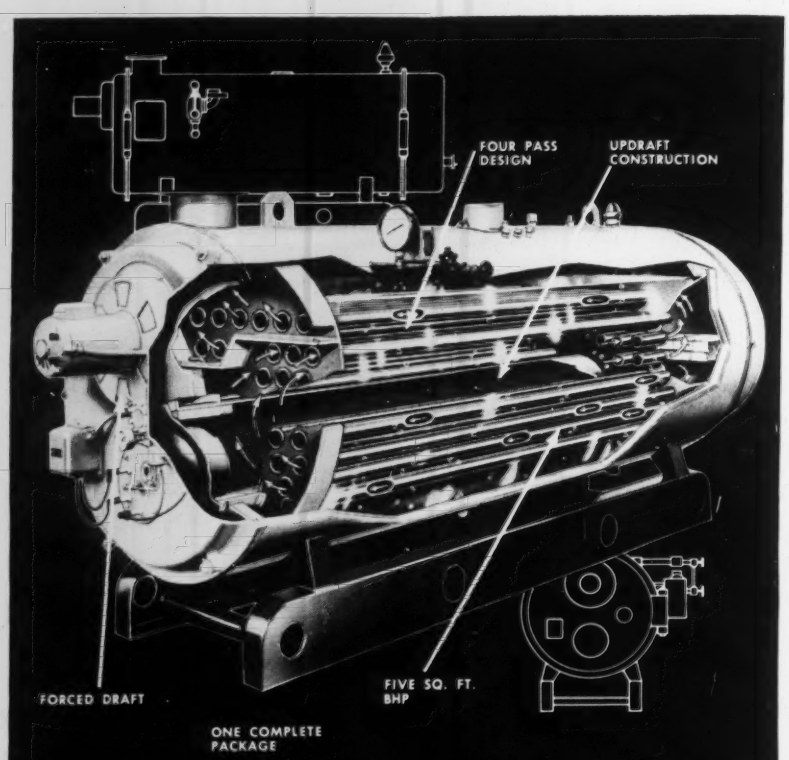


Advanced design for heating

Cleaver-Brooks Progress boilers with integrated packaged design pay big dividends in economical production of steam or hot water.

Here's a boiler that was designed expressly for efficient, lower cost commercial heating by engineers who've made progress their specialty. Progress packaged boiler offers advantages for boiler owners never before available in commercial heating applications . . . advantages tailored in a wide range of sizes for schools, apartments, hospitals and small and medium industrial plants.

Cleaver-Brooks packaged design makes the big difference. Progress boiler is factory assembled and then performance tested . . . delivered ready to operate. Nothing to adjust. For example, controls are prewired and checked; you simply bring in the power source. Thus Progress boiler is unusually easy to install . . . producing greater profits for you.

Progress boiler is built to the high standards of large industrial boilers. Four pass design develops high operating efficiency — a guaranteed minimum of 80%. Progress boiler requires no expensive chimney, either. Forced draft design provides all air for combustion in just the right quantity for high combustion efficiency. The Progress boiler burns clean . . . operates for months without cleaning. And Cleaver-Brooks backs the Progress package all the way . . . a Cleaver-Brooks service man starts the boiler for you . . . adjusts it on the job site and trains the boiler operator.

Select Progress packaged heating boilers in sizes up to 2,010,000 btu/hr. Designed for oil, gas, or combination firing with quick fuel changeover. For the full story on the Progress boiler design superiority call your nearby Cleaver-Brooks representative. Or write Cleaver-Brooks Company, Dept. K, 313 East Keefe Avenue, Milwaukee 12, Wisconsin.

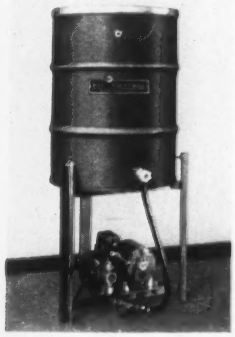
Cleaver Brooks

Progress

Packaged Heating Boiler

EQUIPMENT DEVELOPMENTS

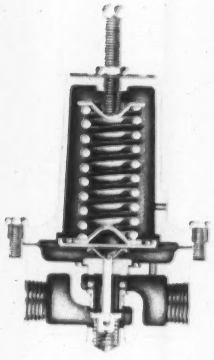
Continued



Pump-Tank Combination

. . . for boiler water treatment — *B-I-F Industries, Inc., Dept. HPAC, Providence 1, R.I.*

Pumping capacity is 50 gph for discharge pressures up to 1100 psi. Pump mounted on steel support containing molded polyethylene 55 gal tank. Unit is 53 in. high, made of corrosion-resistant materials.



Reducing Valve . . .

. . . designed for control of both steam and air — *Mason-Neilan Div., Worthington Corp., Dept. HPAC, Nahatan St., Norwood, Mass.*

Includes sizes of ½, ¾, and 1 in. iron construction with pressure ranges of 2 to 12, 8 to 50, and 25 to 150 psi.

Pressure Control . . .

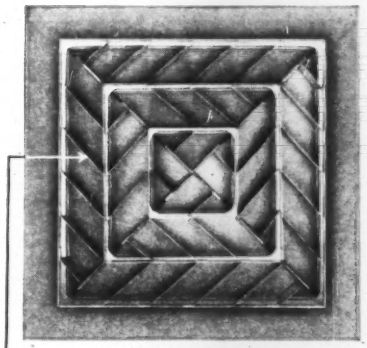
. . . where explosive gases or vapors are present — *United Electric Controls Co., Dept. HPAC, 85 School St., Watertown 72 Mass.*

it's what's inside that counts!

AGITAIR® air diffusers

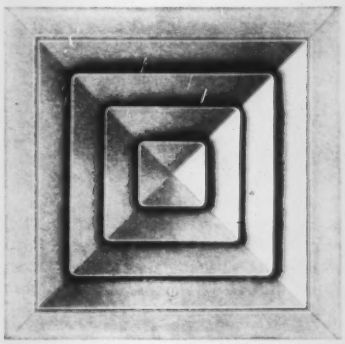
WITH BUILT-IN DIFFUSING VANES CONTROL EVERY CUBIC FOOT OF AIR IN ANY ENCLOSURE

AGITAIR Diffuser



These AGITAIR DIFFUSING VANES provide 64 active air jets to every square foot of the diffuser.

Most Copied Design



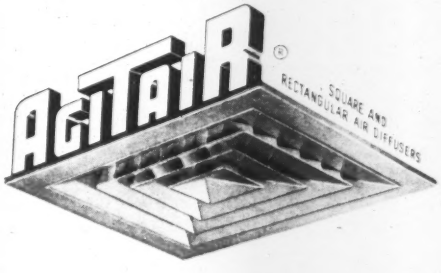
AGITAIR originated square and rectangular designed diffusers.

AGITAIR unequaled performance efficiency ...job-proven more than 1,000,000 times

Air Devices Inc., engineers designed, developed and pioneered the application of AGITAIR square, rectangular air outlets with built-in diffusing vanes to replace the use of unpredictable air distribution from vaneless plaques.

Today, more than 1,000,000 AGITAIR custom-made square and rectangular diffusers are installed on thousands of applications in all kinds of business.

AGITAIR diffusers provide 100% draftless air distribution from any location in the ceiling or sidewall with blows in 1, 2, 3 or 4 directions and with no stagnant areas in the conditioned spaces. No blank offs.



The vane and louvre construction of AGITAIR square and rectangular air diffusers produces counter-flowing air streams or jets (64 to a square foot). This action induces movement of **all** room air toward the diffuser while rapidly mixing the conditioned air with room air to assure instantaneous temperature equalization and draftless distribution. Plaques are incapable of performing these basic functions.

Every feature of these AGITAIR diffusers has been designed to assure complete users satisfaction. Appearance . . . performance . . . noiseless . . . draftless air distribution. For complete engineering data on these AGITAIR custom-made diffusers ask your local AGITAIR representative or write direct to Air Devices Inc.

air diffusers • filters • exhausters
registers and grilles

Sold exclusively by representatives for:

AIR DEVICES INC.

185 MADISON AVENUE, New York 16, N. Y.

NEW sulfamic acid-based cleaners are supplied in light, disposable cartons. They're stored and handled dry ...no spillage or breakage worries.

OLD-style liquid acid cleaners—shipped in cumbersome, returnable carboys—require careful handling to prevent breakage.

✓Safer, easy to handle

Just one of the reasons why **Dry Acid Cleaners** based on **Du Pont Sulfamic Acid** are gaining wide favor for industrial equipment cleaning: ✓ Safer to handle ✓ Easy to use ✓ No hazardous fumes ✓ Powerful descaling action ✓ Less corrosive ✓ Lower handling and shipping costs.

CLEANERS BASED ON SULFAMIC ACID REMOVE SCALE AND DEPOSITS FROM:
Air-Conditioning Cooling Towers, Ice-Making Machines, Evaporating Condensers.

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Wilmington 98, Delaware

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Firm_____ Title_____

Address_____

City_____ State_____

EQUIPMENT DEVELOPMENTS

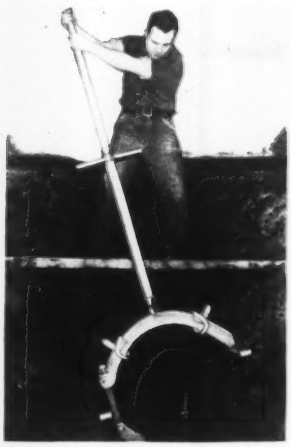
Continued

Several system differentials available between limits of 30 in. Hg and 40 psi, with switch differentials from 0.5 ± 1/10 in. Hg and up; switches are single pole and suitable for ambient temperatures up to 100 F rated at 15 or 20 amp, 115/230 volts a-c.

Electrode Holder . . .

. . .for tungsten-inert-gas welding—*Air Reduction Sales Co., Dept. HPAC, 150 E. 42nd St., New York 17.*

Shaped like large lead pencil, rated at 100 amps a-c or d-c; accommodates electrodes 0.020 to 3/32 in. up to 3 in. lengths.



Pipe Cutters . . .

. . .requiring no power source—*Reed Mfg. Co., Dept. HPAC, 1425 W. 8th St., Erie, Pa.*

For steel and cast iron pipe from 12 to 24 in. diam; consists of separable circular frame joint at midsection, aluminum handle for tightening cutter as cut proceeds; four-wheel design requires 45 to 60 deg of handle swing. Bulletin "RCP-21" available on request.

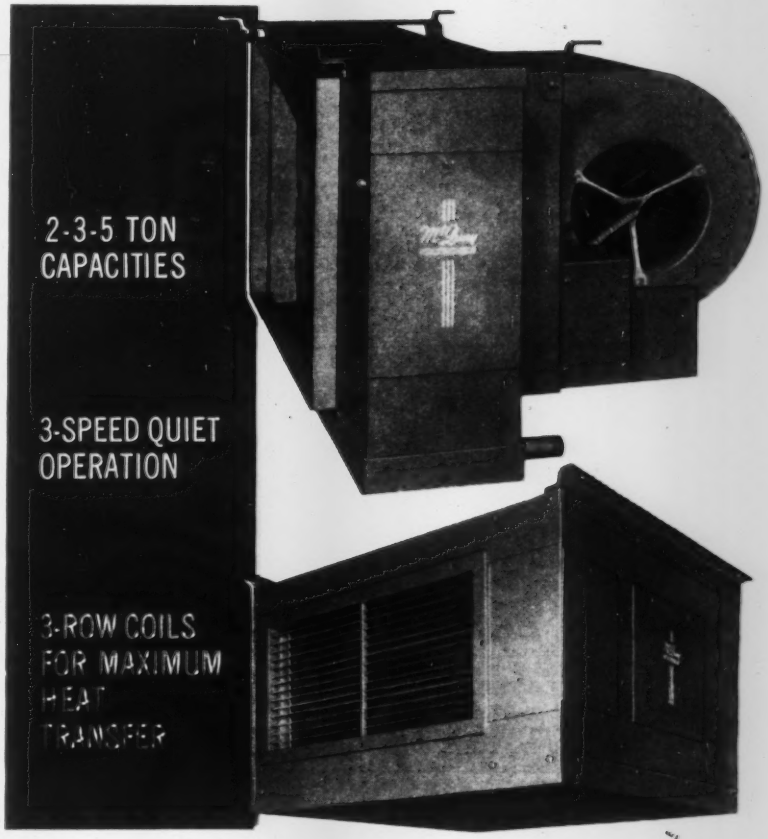
you can both HEAT and COOL with these large capacity

McQuay SEASONMAKERS

These extremely popular large capacity McQuay Seasonmakers enable you to provide year 'round comfort at any desired temperature level . . . heated, filtered air in cold months, and cooled, dehumidified, filtered air in warm months . . . when used with a hot or chilled central water supply.

They are particularly designed for commercial or residential applications where a direct air distribution system is necessary, or for use in medium to large areas requiring 2, 3 or 5 tons capacity. Units are also available for refrigerant operation.

You'll like the 3-speed, quiet operation and the double drain pan with ½" insulation for protection against sweating and the auxiliary drain pan to catch condensate from the control or shutoff valve. In fact, you'll like everything about these McQuay Seasonmakers. For complete information, see your McQuay representative, or write McQuay, Inc., 1601 Broadway Street N. E., Minneapolis 13, Minnesota.



Write for catalog No. 721 for complete selection and capacity information.

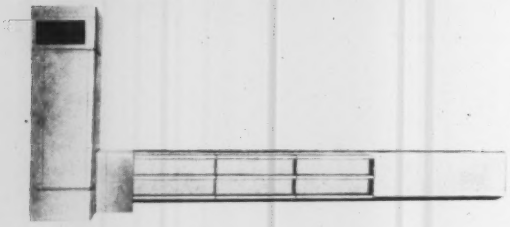
McQuay Means Quality

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

EQUIPMENT DEVELOPMENTS

Continued



Schoolroom Heating . . .

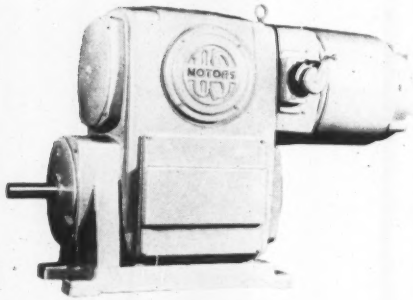
. . . designed to meet health, comfort, and safety standards — *Janitrol Heating & Air Conditioning Div., Surface Combustion Corp., Dept. HPAC, Columbus* 16, *O.*

System is self-contained perimeter type incorporating outdoor air modulating damper and control system. Cabinet is fire resistant and heating section is approved for all types of gases. Bulletin No. JS 112 11 available on request.

Temperature-Pressure Regulator . . .

. . . for steam, water, air, oil, gas, chemicals—*OPW Jordan, Dept. HPAC,* 6013 *Wiehe Rd., Cincinnati* 13, *O.*

Suitable for pressures to 250 psi and temperatures to 450 F in sizes from 2¼ in. and 3 in. with either 125 or 250 lb ASA flanges. Bulletins "SRBc 31-59", "JNP-1", and "J-180" give complete details on self-contained regulator.



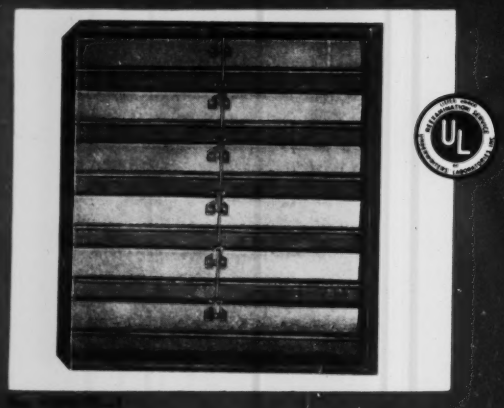
Variable Speed Transmission . . .

. . . for ratings between 30 and 60 hp — *U. S. Electrical Motors Inc., Dept. HPAC, Box* 2058 *Terminal Annex, Los Angeles* 54.

Available with single belt drive (rated to 40 hp with up to 6:1 speed variations and at 60 hp with 6:1 speed variations). Both models feature sub-base construction for upright or horizontal mounting.

FIRST and ONLY FIRE DAMPER

TO RECEIVE THE UNDERWRITERS' LABORATORIES APPROVAL



This acceptance by the UNDERWRITERS' LABORATORIES came only after extensive tests with FIRE DAMPERS constructed according to the present Bulletin No. 90 SERIES, which failed to pass the test, and the IMPERIAL DAMPER No. VWNYT-1, which passed the test, and now carries the UNDERWRITERS' LABORATORIES LABEL.

We, also, at this time, proudly announce the APPROVAL AND LABELING of the IMPERIAL DAMPER No. VWNYT-1 by the BOARD OF STANDARDS AND APPEALS FOR USE IN NEW YORK CITY. This is the FIRST AND ONLY DAMPER to date to carry this approval and label.

Send for Our New Informative Brochure!

IMPERIAL DAMPER COMPANY

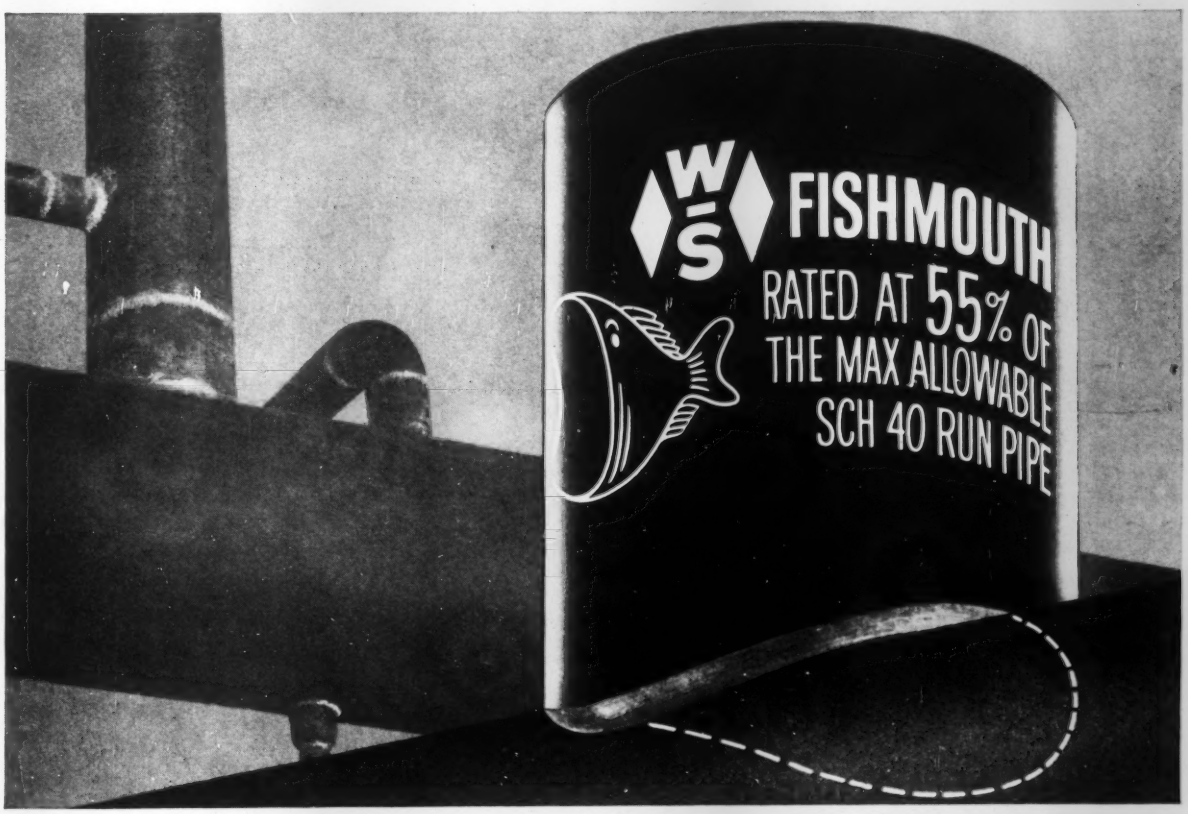
Manufacturers of Volume Dampers, Multi-Blade Dampers, Automatic Dampers, Automatic Shutters, Back-Draft Shutters, Louvers, Stationary and Adjustable Extruded Aluminum Louvers.

664 EDGECOMBE AVENUE
NEW YORK 32, N. Y.
LORRAINE 8-9100

FOR BRANCH CONNECTIONS 2 INCHES OR OVER:

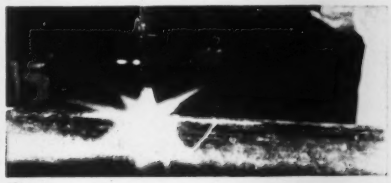
Now! Only 81¢ for a 2″ branch fitting!

THAT'S ALL A NEW, READY-MADE W-S FISHMOUTH COSTS

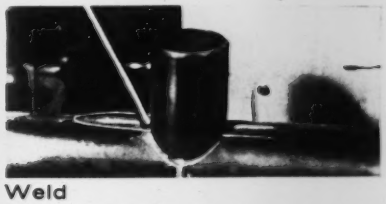


IT'S THE MOST PRACTICAL WAY TO MAKE A BRANCH CONNECTION

Mark



Cut



Weld

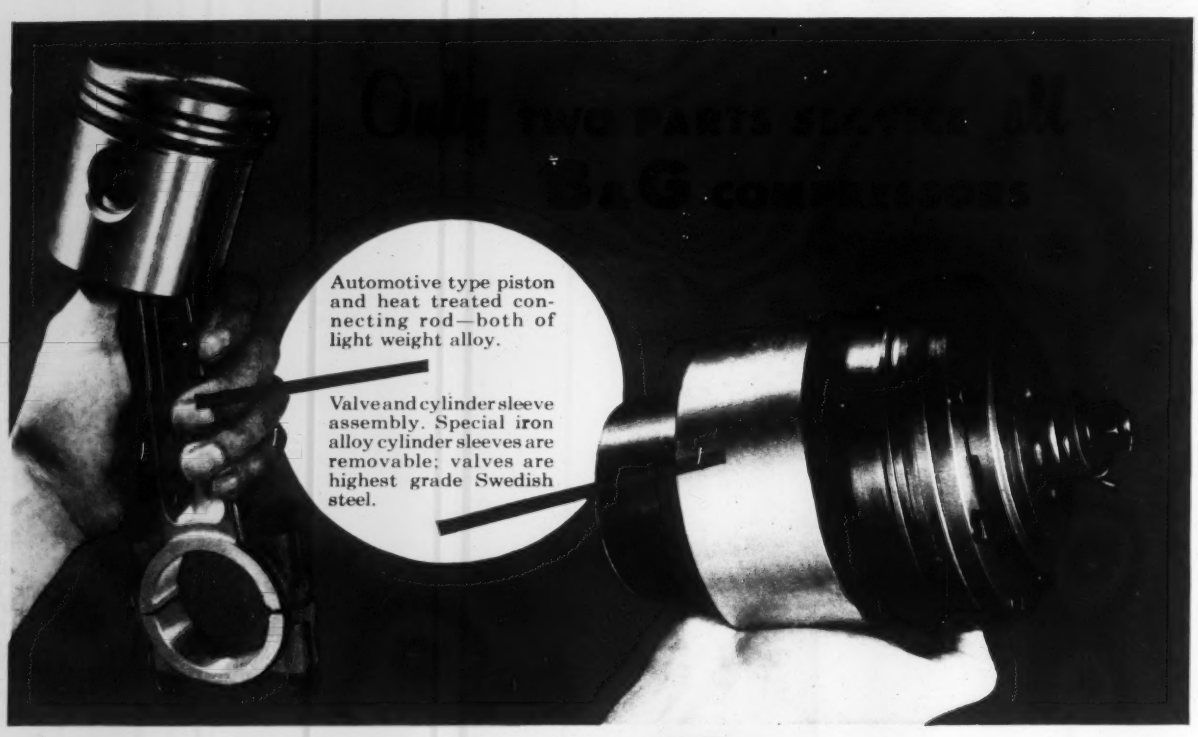
The W-S FISHMOUTH saves 50 per cent or more over commercially available branch fittings . . . *costs even less than your own field- or shop-made connection.* Made from Schedule 40 pipe, W-S FISHMOUTH is fully machined and perfectly shaped for strong, leak-proof joints. A ready-made W-S FISHMOUTH is rated for working pressures to 55 per cent of maximum run-pipe limits. Sizes: 2″ to 12″ IPS, butt weld ends. Fewer sizes handle many more jobs, eliminate need for special fittings.

No time or cost required to shape, fit or bevel. Ideal for close-quarter work. Easy access to inspect weld penetration or to back-weld. W-S factory machining means a secure, permanent installation every time.

Ready-made, the W-S FISHMOUTH costs less to buy and install than anything you can buy or make. Write, today, for complete information, prices and names of distributors to: *Forge and Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, N. J.*

FORGE AND FITTINGS DIVISION PORTER **H.K. PORTER COMPANY, INC.**

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Specialty Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A.; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD


Automotive type piston and heat treated connecting rod—both of light weight alloy.
Valve and cylinder sleeve assembly. Special iron alloy cylinder sleeves are removable; valves are highest grade Swedish steel.

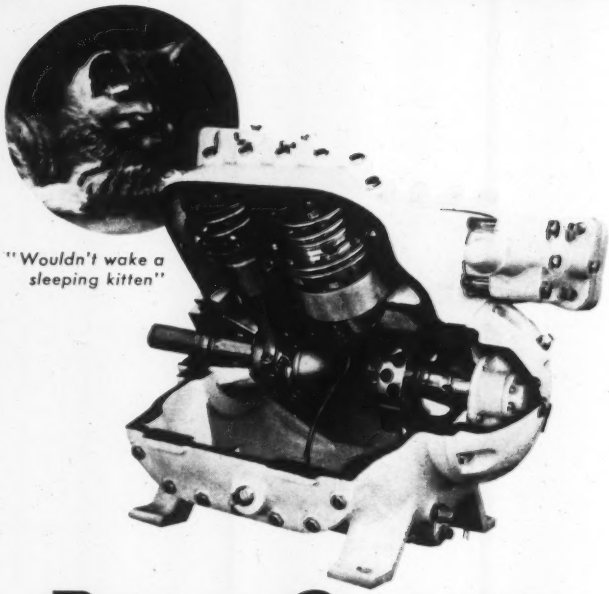
You'll seldom need to service a B&G Compressor—but when you do, all the parts needed *can be carried in two hands.* Piston and rod assembly, and valve and cylinder assembly *will handle 95% of all B&G compressor repair problems!*

B&G Compressors are completely new in conception—*not* adaptations of 20-year-old designs. B&G engineering has created a compressor basically superior because it's basically simpler. These compressors have fewer maintenance problems, because they have fewer parts.

Add to this new superior design, *precision manufacture*—with every major part made and guaranteed by Bell & Gossett. The result is a compressor unmatched for efficiency, quiet operation and freedom from vibration. *Any vibration is no greater than that of a well balanced electric motor.*

B&G Compressors are incorporated in all B&G Package Liquid Coolers and Condensing Units. They can be equipped with multi-step capacity control systems...standard equipment includes gas and oil equalization ports, magnetic plugs and oil sight glass.

For greater efficiency, greater value per dollar, specify B&G Compressors and Refrigeration Equipment. Send for complete file of specifications and application data on B&G Air Conditioning and Refrigeration Equipment.



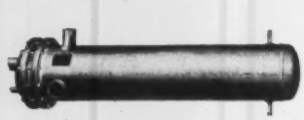
BELL & GOSSETT

COMPANY

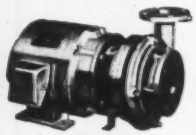
Dept. RFW-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

COMPLETE LINE OF REFRIGERATION AND AIR CONDITIONING "PACKAGES" AND COMPONENTS

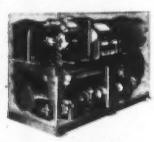


B&G Evaporator



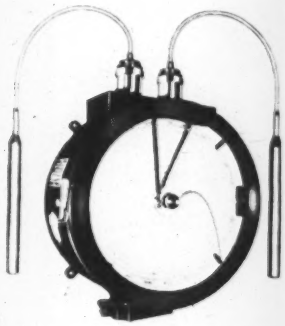
B&G Centrifugal Pumps

B&G Condenser



B&G Package Liquid Cooler

EQUIPMENT DEVELOPMENTS
Continued



Recording Thermometer

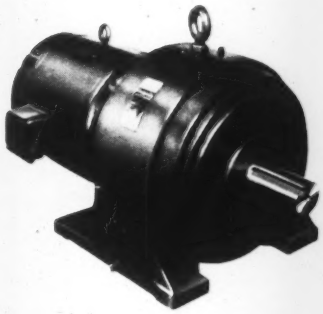
. . . to sense and record temperatures up to 1100 F—*Partlow Corp., Dept. HPAC, Campion Rd., New Hartford, N.Y.*

Equipped with two thermal sensing elements and two pen mechanisms in same body, available with electric or spring-driven chart drives.

Industrial Tapes . . .

. . . adaptable for sealing pipes and ducts — *Labelon Tape Co., Inc., Dept. HPAC, 450 Atlantic Ave., Rochester 9, N.Y.*

In 1, 2, 5 mil thickness in widths of ¼" to 1 in.; has tensile strength of 20,000 psi; resistant to abrasives, chemicals, moisture.



Gear Drives . . .

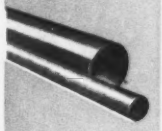
. . . rated in accordance with applicable standards—*Wagner Electric Corp., Dept. HPAC, 6400 Plymouth Ave., St. Louis 14, Mo.*

For speed reduction units 125 hp and smaller with output speeds ranging from 780 to 1.2 rpm at 1750 rpm input speed; shaft mounted drives available through 40 hp.

Life in these excited states...

"Glad to see you're a man with ideas, Henry"

ACE-ITE
all-purpose toughie



High-impact, rubber-plastic, most economical for average chemicals. ½ to 6". Screw or solvent welded fittings. Valves ½ to 2". NSF-approved. *Bul. 80A.*

ODD SHAPES?
you make...we line

Rubber or plastic lining is economical life insurance for costly "special" equipment. It's a specialty with ACE. Write for *Bul. CE-53.*

PLASTIC VALVES
for matched systems

Choice of Riviclor PVC, Ace-Ite rubber-plastic, Ace polyethylene or Ace Saran to match *any* plastic pipe. Sizes ½ to 2". Also larger plastic-lined valves.

Why men with ideas choose ACE equipment

Leading chemical design and development men work in the future... with no time to go back over specifications for equipment that didn't work out. You'll find they reach for Ace corrosion-engineered equipment time and again...just to be *sure*. If equipment failures give *you* no time to think ahead, it's time to give us a call.

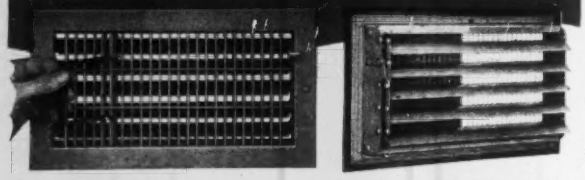
Ace-Hide, tough as a rhinoceros, insensitive to corrosives, makes this finest of acid pails. Also dippers, bottles, funnels, etc.

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
DIVISION OF AMERACE CORPORATION
Ace Road • Butler, New Jersey

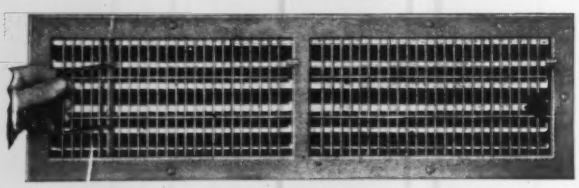
DIRECTED AIR FLOW
at any angle with

INDEPENDENT "Fabrikated" AIR CONDITIONING REGISTERS



321-A HMV — Rear View Showing "HMV" Valves

Every grille bar adjustable individually—before or after installation



321-A HMV Tandem

Any direction of air flow—right, left, up, down and any combination—is easily obtained with "Fabrikated" Style No. 321-A HMV air conditioning registers, for residence or commercial installations, on sidewalls or ceiling. The face bars are adjustable to right or left; valves on the back are adjustable to direct the air flow up or down; valves may also be fully closed, and are connected to open or close in unison.

The angles of deflection and the combinations to be had are practically unlimited. Adjustments for directed air flow may be made before or after installation. Grille bars are held firmly in place and will not vibrate or rattle.

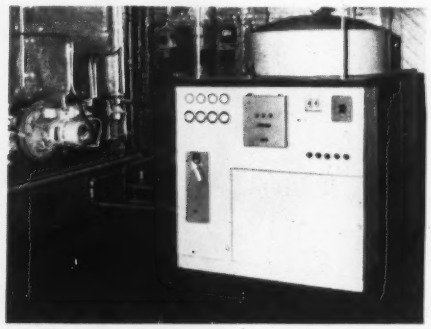
"Fabrikated" registers are available in sizes from 8 x 4″ to 48 x 24″, including tandem style. Special sizes can be made without special die set-up charges.

Write for Catalog.

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

EQUIPMENT DEVELOPMENTS

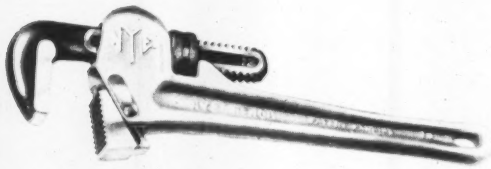
Continued



Boiler Water System . . .

. . .to keep boiler water free from sludge and suspended solids—*Sparkler Filtrion Corp., Dept. HPAC, North Chicago, Illinois.*

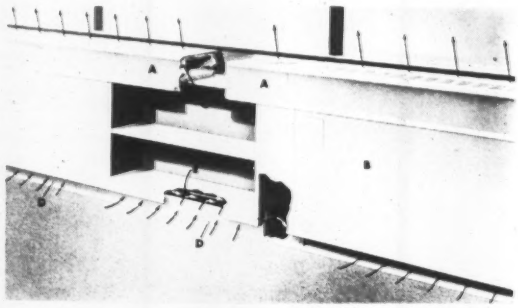
System based on continuously recirculating boiler water through side-stream filter. Available in standardized models for steam boilers up to 1000 hp and customized units up to 6000 hp.



Pipe Wrench . . .

. . .reduces hand adjustments for sizes to minimum — *Nye Tool Co., Dept. HPAC, 4120 W. Fullerton Ave., Chicago 39.*

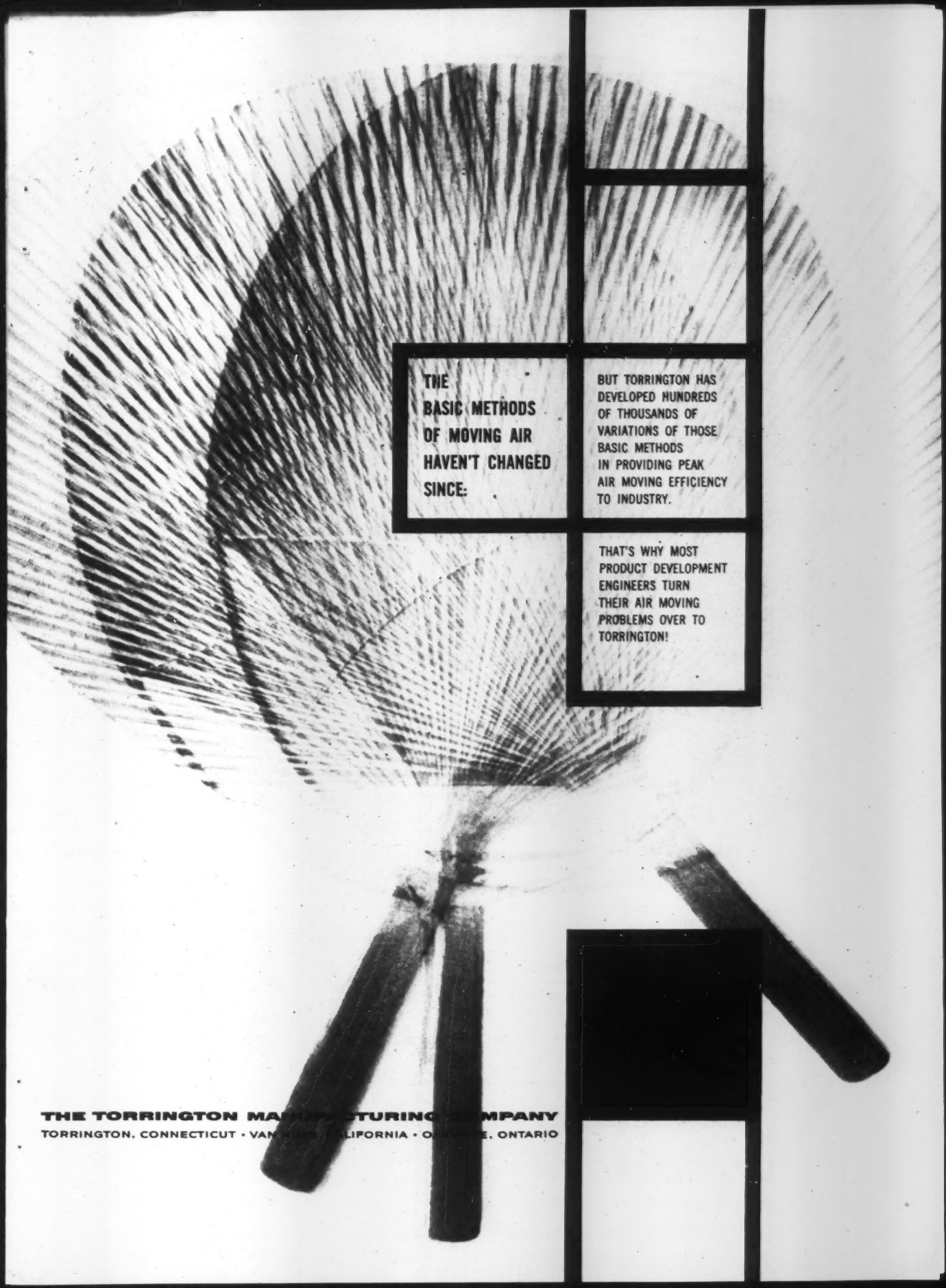
Constructed with steel forged jaws and handle of alloyed malleable iron to accommodate variations in diameter. Hand manipulation of knurled adjusting screw unnecessary with self-adjusting tool. Available in standard sizes.



Perimeter Air Conditioning . . .

. . .to keep flow of cool conditioned air along outside wall—*Trane Co., Dept. HPAC, LaCrosse, Wisc.*

Ducts extending air outlets along perimeter of room make it possible to air condition spaces with one unit of larger capacity; can be used in combination with separate duct supply of conditioned air or as independent air conditioning system.


THE BASIC METHODS OF MOVING AIR HAVEN'T CHANGED SINCE:
BUT TORRINGTON HAS DEVELOPED HUNDREDS OF THOUSANDS OF VARIATIONS OF THOSE BASIC METHODS IN PROVIDING PEAK AIR MOVING EFFICIENCY TO INDUSTRY.
THAT'S WHY MOST PRODUCT DEVELOPMENT ENGINEERS TURN THEIR AIR MOVING PROBLEMS OVER TO TORRINGTON!
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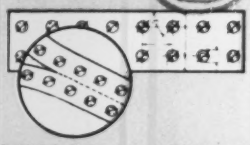
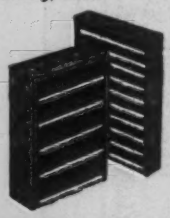
Another CAINS COIL OF PROFIT
LOUVERAIL

ELIMINATES
Layout—Tab Cutting, Hole Punching, Riveting, Spot Welding, Etc..





Split (½) Rail for Louver thicknesses from 1¼ to 1¾". Use Full Size Rail for Louver thickness from 3¼" to 4".

Try this economical and practical method for fabricating Louvers — removable, hinged, or stationary. Louverail is 24 ga. galv. 4½" wide in (2—50' lengths) 1 right and 1 left coiled together. Hundreds of varations possible.

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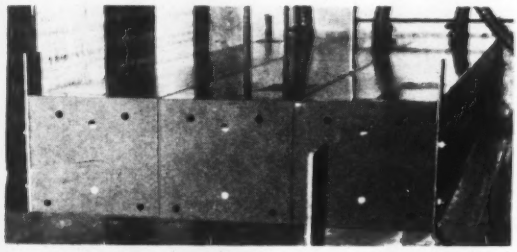
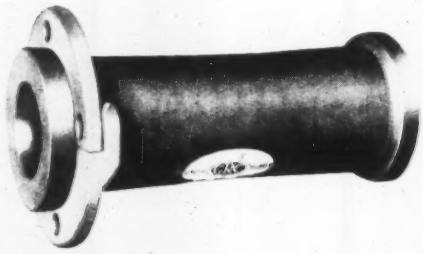
Continued



Infra-Red Humidifier . . .

. . . to effect evaporation by direct radiation — *Humidaire Corp., Dept. HPAC, 313 W. Main St., Genoa, Ill.*

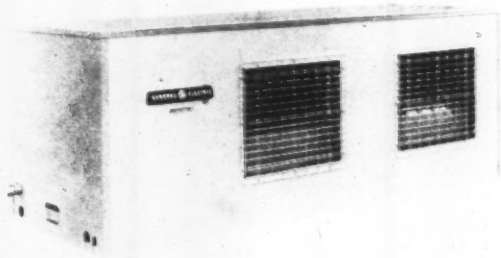
Humidifier is made in 13 standard sizes with capacities from 0.32 to 7.30 gal per hr for large building applications. Combinations and multiple of standard sizes can offer vapor output tailored to specific requirements, according to manufacturer.



Rubber Pipe . . .

. . . for application in air conditioning, heating systems and for abrasive or corrosive liquids or slurries — *General Rubber Corp., Dept. HPAC, 55 Summit St., Tenafly, N.J.*

Available in all standard diameters from 1 to 12 in. and any standard face-to-face length, no gaskets required. Maximum working pressures of either 150 or 250 psig.

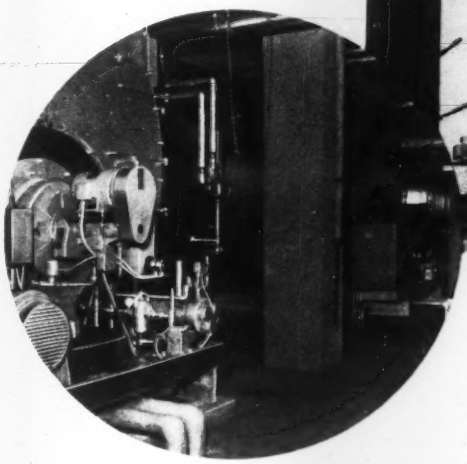


Heat Pump . . .

. . . in 5 ton capacity — *General Electric Co., Dept. HPAC, Tyler, Texas.*

Split-system heat pump utilizes outdoor remote unit and indoor air handling unit. Blower motor has variable-speed, 115/230 volt supply. Ball-bearing blower permanently-lubricated, cushion mounted, belt driven.

Where the *steam* comes from



....for Mutual Benefit Life's fine new buildings in Newark, N. J.

Complete firing system in one package. Every factor that affects firing efficiency is engineered into the unit at the factory. The unit includes: (1) Single or dual-fuel burner, with complete fuel handling systems. (2) Forced draft air supply. (3) Enclosed control panel, with instruments mounted, factory wired and tested, and with signal lights and gauges that afford a complete reading at a glance. In the oil-gas units, fuels can be switched automatically, or with the simple flick of a switch.

Fire low cost residual oils

The heavy residual fuel oils (No. 5 and 6) have higher heat value than light heating oils, yet cost less per gallon.

The Iron Fireman boiler-burner units shown here fire these sluggish oils with complete dependability. They protect against fuel emergencies because they can fire *any* grade of oil, light or heavy.

Gas or oil—switch fuels instantly

Dual-fuel models fire either gas or oil, and can be switched either by manual or automatic controls. In some areas gas rates are substantially less for customers whose steam plants switch automatically from gas to oil firing when outdoor temperature falls below a certain level, relieving the load on main gas lines when demand is highest.

Fires all types of boilers

Iron Fireman residual oil firing (with or without gas) is available in complete boiler-burner units ready for service connections, or as a package firing system that can be applied to any type of boiler.

Send coupon for further information

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT

FOR OIL - GAS - COAL

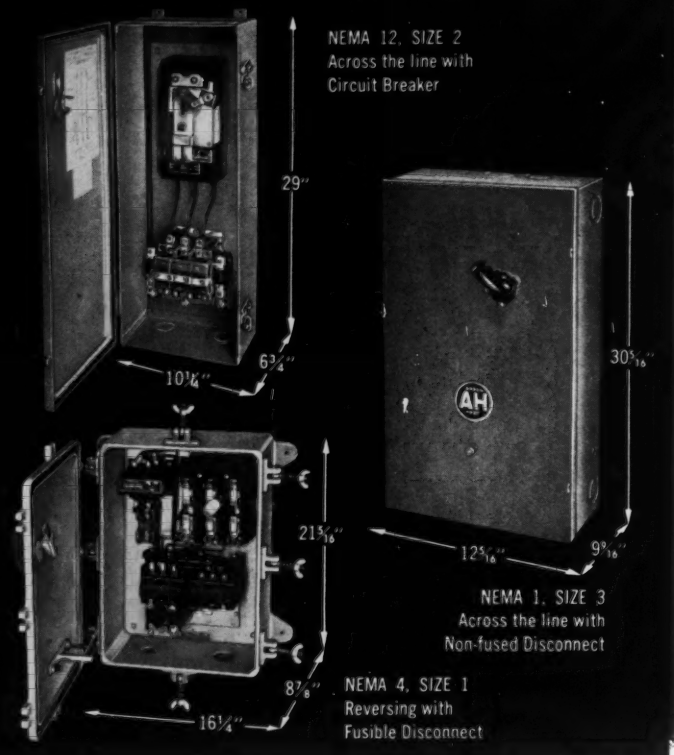
IRON FIREMAN MANUFACTURING COMPANY
3164 West 106th Street, Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto, Ontario)

Please send information on Iron Fireman forced draft firing for oil, gas or oil-gas combination.

Name _____

Address _____

City _____ State _____



ARROW AH HART

Announcing: **A COMPLETE LINE OF COMPACT, LIGHTWEIGHT COMBINATION STARTERS**

Sizes 0, 1, 2, and New Sizes 3 and 4 — and NEW CAST ALUMINUM WEATHERPROOF and EXPLOSIONPROOF ENCLOSURES

Starters are of exclusive "Right Angle" Design which brings important installation, maintenance and performance benefits. For convenience and safety, unit is front operated by means of Fused or Unfused Disconnect, or Circuit Breaker. Circuit Breakers are Instantaneous or Thermal Magnetic Trip Types. *No other line offers enclosures that facilitate mounting and handling like the new cast aluminum NEMA 4 Weatherproof and NEMA 7 and 9 Explosionproof – Enclosures that are one-half the weight of old-style cast iron boxes.* Other available enclosures: General Purpose (NEMA 1) and Industrial (NEMA 12 – oil-tight and dust resistant).

Write for new folder on A-H Combination Starters to: The Arrow-Hart & Hegeman Electric Company, Dept. HPAC, 103 Hawthorn St., Hartford 6, Conn.

ARROW AH HART

Quality since 1890

MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES

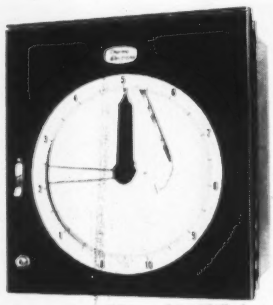
EQUIPMENT DEVELOPMENTS

Continued

Boiler Cleaner . . .

. . .of portable manually propelled type—*Pullman Vacuum Cleaner Corp., Dept. HPAC, 25 Buick St., Boston, Mass.*

Features 1½ hp, 3-stage, bypass (self-cooling) motor; operates on 115 volts, 60 cycles a-c and d-c; 17 gal capacity and total recoverable capacity of 12 gal.



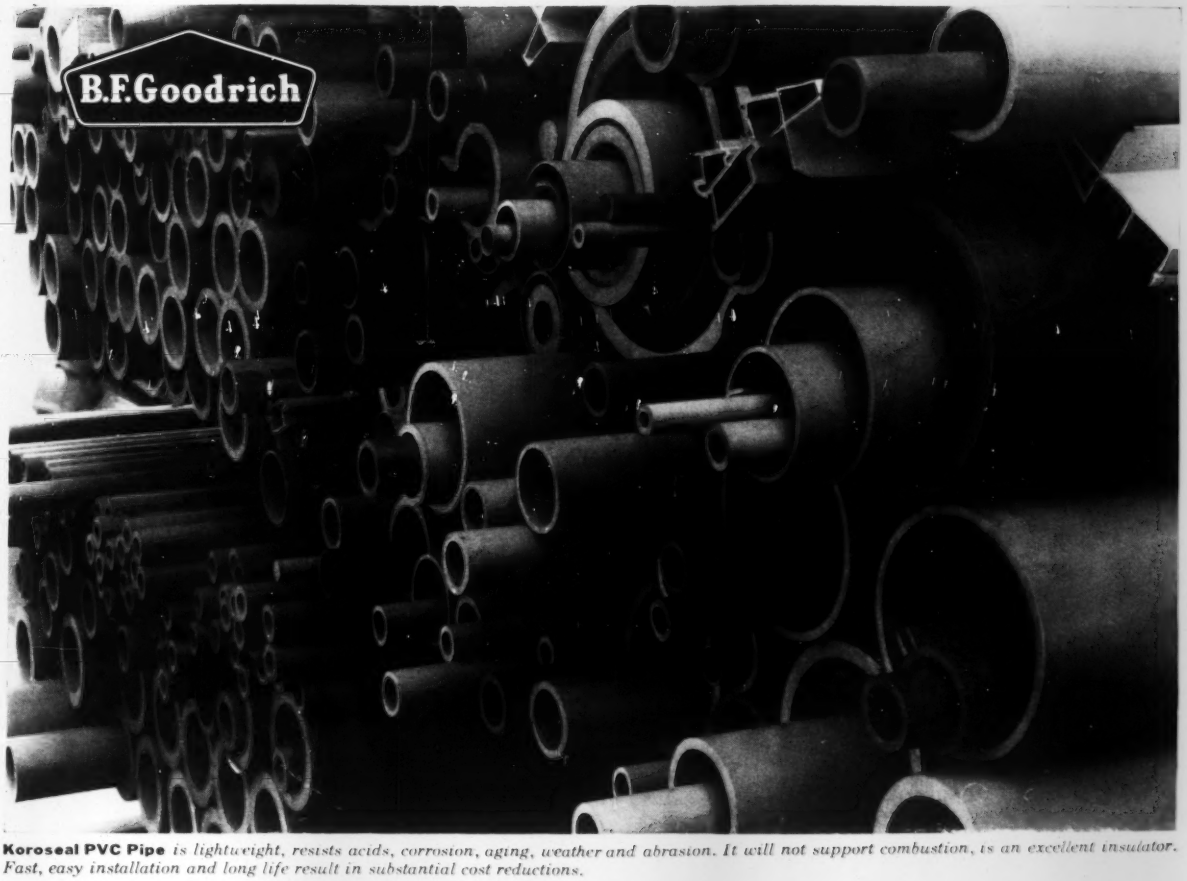
Recorder Controllers . . .

. . . for applications including conductivity, flow, humidity, pressure, temperature measurement—*Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N.J.*

Records and/or controls any process variable convertible to voltage or resistance change with accuracy to ±0.25 percent or scale or 5 microvolts; sensitivity is ± 0.125 percent; stability is ± 1 microvolt.

Atomizing Deaerator . . .

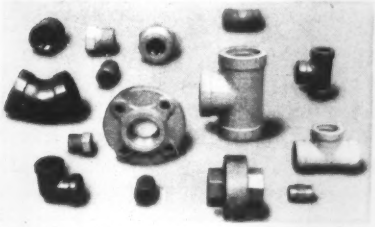
. . .for marine applications—*Cleaver-Brooks, Dept. HPAC, 225 N. Grand Ave., Waukesha, Wisc.*



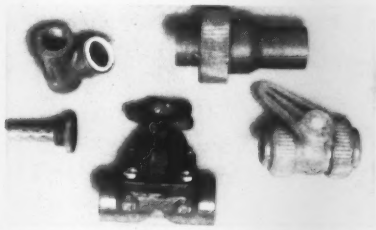
Koroseal PVC Pipe *is lightweight, resists acids, corrosion, aging, weather and abrasion. It will not support combustion, is an excellent insulator. Fast, easy installation and long life result in substantial cost reductions.*

Specify Koroseal PVC pipe and fittings for long life at low cost

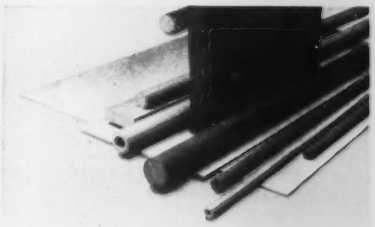
The more severe the service conditions, the more apparent are the superior properties and quality of rigid Koroseal PVC pipe, fittings, valves and sheet. Koroseal PVC is delivering long, trouble-free service in a multitude of industrial applications where corrosion, chemicals, high pressures and physical abuse ruined other types of pipe in a hurry. And savings are substantial—on original cost, installation costs, reduced maintenance and longer life. Investigate the many advantages of Koroseal PVC pipe now. For details, etc., write Dept. HP-9. *B.F.Goodrich Industrial Products Company, Marietta, Ohio.*



Koroseal PVC Fittings *can be joined to Koroseal pipe by solvent-cementing, heat welding, flanging or threading. Recessed threads protect against damage, eliminate cross threading. There's a size and type for every need.*



Koroseal Valves—*excellent for handling fluids, gases and corrosive materials. Complete selection of diaphragm, ball, and check valves for all types of service. Strainers and other piping components also available.*

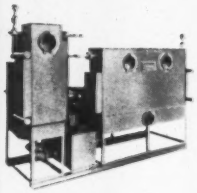


Sheet, Tubing, Rods—*Koroseal PVC also is available in other forms . . . sheet and fabrication aids for duct work . . . bar stock for machined parts . . . tubing for special uses.*

B.F.Goodrich *Koroseal rigid PVC products*

KATHABAR® SYSTEMS

Give these advantages to specifying engineers:



STERILE AIR

Now you can design spaces to maintain air sterility as scientifically as temperature and humidity. Only Kathabar enables you to deliver air at 5 micro-organisms per 10 cu. ft. or less, continuously.

PRECISE DESIGN

Reduce dew point of air from 72 F to 46 F with 85 F water! No over-cool & re-heat costs. Kathabar lets refrigeration handle sensible cooling only (sensible, economical). Deliver consistent gr./lb. and DB for process, storage, testing in foods...concrete... chemicals...paper... printing...rocket fuels... "clean" rooms...everywhere.

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2384 Dorr Street, Toledo 1, Ohio

Surface

Send facts on Kathabar systems for following application:

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59-3E

EQUIPMENT DEVELOPMENTS
Continued

Provides removal of dissolved gases in boiler feed water with capacities from 15,000 to 1 million lb of water per hr; reduces oxygen content of effluent to less than 0.005 cc per liter.

Spray Nozzles . . .

. . . with adjustable joints—*Spraying Systems Co., Dept. HPAC, 3219 Randolph St., Bellwood, Ill.*

Range of adjustable joint sizes for manufacturer's spray nozzles includes all capacities from those for $\frac{1}{4}$ in. pipe connection to larger units for $2\frac{1}{2}$ in. pipe connection. Materials used include brass, steel, and stainless steel. Ball and socket design permits positioning, rotating nozzle at any angle in 40 to 50 deg arc range.

Expansion Compensator . . .

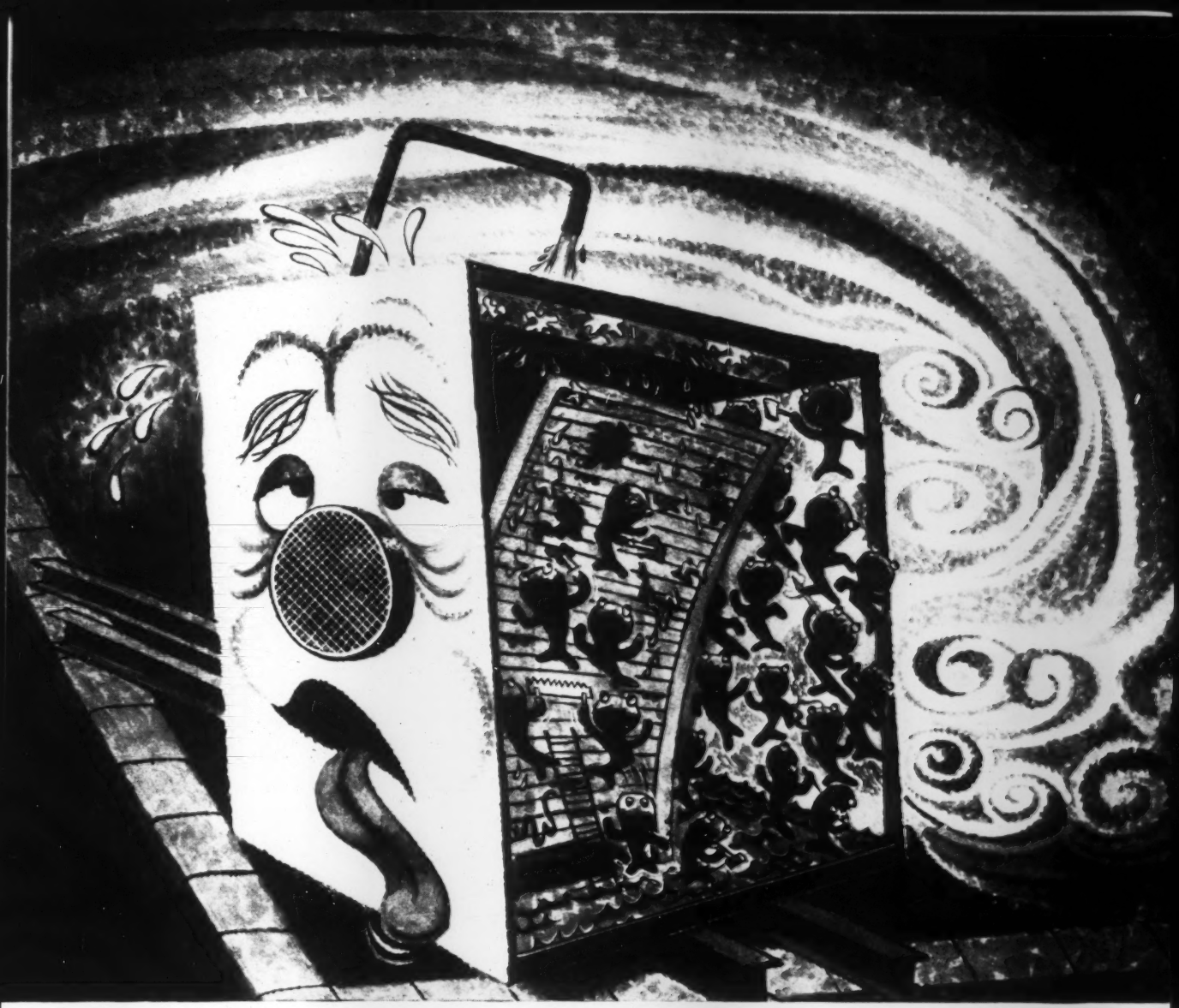
. . . for axial movement in steam and hot water lines—*Solar Aircraft Co., Dept. HPAC, 2200 Pacific Hwy., San Diego 12, Calif.*

"Sola-Flex" compensator designed for 150 psig service at 700 F, and will handle axial movement up to $13\frac{1}{4}$ in. Units available in nominal pipe sizes of $\frac{3}{4}$ to 3 in. Designed for minimum service life of 15,000 cycles.

Electric Heaters . . .

. . . designed to heat large areas efficiently—*Berko Electric Mfg. Corp., Dept. HPAC, 212-10 Jamaica Ave., Queens Village, N. Y.*

"Pyrolite" electric heater rated at 1000 watts to produce 3413 Btu per hr. Units controlled by wall mounted switch; can be used with or without separate wall thermostat. Motor is two pole unit bearing type with sealed-in lubrication. Rotor dynamically balanced.



BEFORE YOU BUY, THINK:

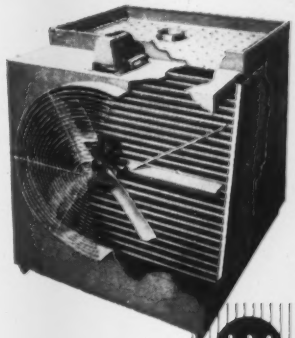
Will fungus attack your cooling tower 2 years from now?

Not if it's a Halstead & Mitchell cooling tower with a 20-Year Guarantee

The specially treated wood decking in H&M towers resists rotting, fungus attack and algae which accumulates and obstructs air flow in most other towers. Performance remains "like new" in H&M cooling towers year after year.

Only Halstead & Mitchell offers a 20-Year Guarantee on the wetted deck against failure due to rotting or fungus attack.

Other H&M features for unusually low maintenance include permanently sealed fan bearings, and a heavy gauge steel cabinet protected against corrosion by three plastic coats applied *after assembly*. Be sure. Ask your local wholesaler for H & M towers, or write to Halstead & Mitchell, Bessemer Building, Pittsburgh 22, Pa.



H & M COOLING TOWER WITH PRESSURE TREATED DECKING

HM

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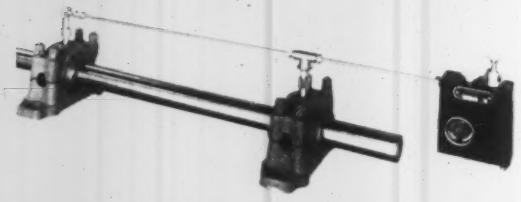
Water-Cooled Condensers · Cooling Towers · Air-Cooled Condensers · Finned Coil Products

EQUIPMENT DEVELOPMENTS

Continued



Lubrication System . . .

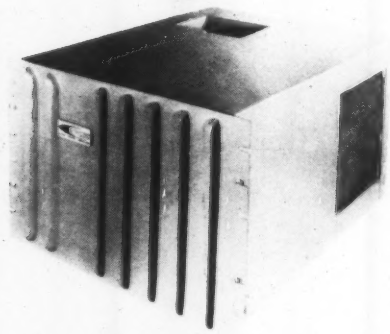
. . . which oils bearings simultaneously in single operation — *Marlo Coil Co., Dept. HPAC, 7100 S. Grand Blvd., St. Louis 11, Mo.*

In forced feed system, plunger delivers measured amount of lubricant to all bearings at pressure of 30 psi, units with 2 or 3 bearings use a system of 60 cc lubricant reservoir — enough for 60 "shots".

Baseboard Radiation Cover . . .

. . . of simulated wood-grain — *Edwards Engineering Corp., Dept. HPAC, 101 Alexander Ave., Pompton Plains, N.J.*

For use in wood-panelled rooms. Comes in lengths of 2 to 20 ft. wall-to-wall installation with various tube sizes, industry-approved ratings: ½ in. and ¾ in. nominal tube sizes plus high capacity units.



Electronic Cabinet Cooler . . .

. . . designed to maintain temperature control of rack mounted electronic equipment — *Airflow Co., Dept. HPAC, 400 S. Stonestreet Ave., Rockville, Md.*

"Model RC-6" is completely self-contained air-cooled air conditioning unit, which can be mounted on any standard 19 in. electronic rack and requires 12¼ in. rack height. Features cited: permanently lubricated bearings; automatic temperature control; sealed refrigeration system; military type finishes.

Low cost gas burner outstandingly efficient at all flame settings

Precision-engineered commercial-industrial Hev-E-Duty power gas burners are the low-cost answer to high heating efficiency with gas. Automatic electric ignition assures safe starting. Built-in low fire start that builds up slowly to the flame size required means smooth, safe operation. Minimum low fire and maximum high fire can be controlled exactly for top efficiency with any boiler or furnace.

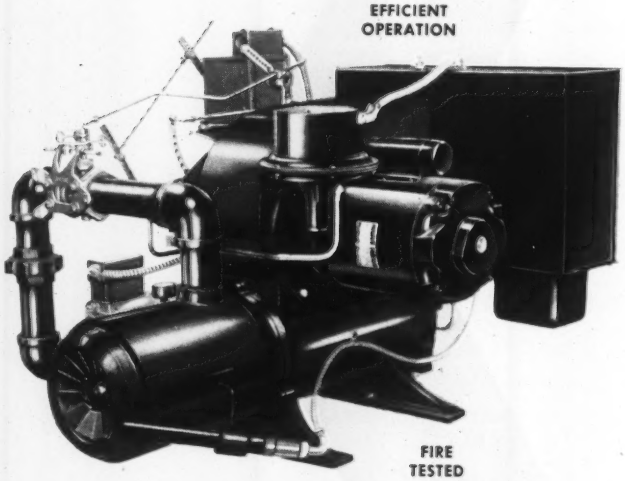
Once set, the burner maintains this setting automatically regardless of weather. Sizes from 720,000 to 21,000,000 BTU. Hev-E-Oil and combination gas/oil models also available. For more information write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wis., Dept. HPA-959.

COMPLETE PACKAGE

SIMPLE INSTALLATION

LOW FIRE START

EFFICIENT OPERATION



FIRE TESTED

FULLY APPROVED

FACTORY GUARANTEED

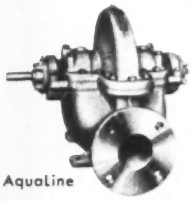
INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4507 N. OAKLAND AVE., MILWAUKEE 11, WISCONSIN

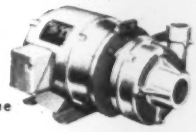
THESE QUALITY PUMPS CUT COSTLY SERVICE CALLS

PEERLESS PUMPS

PEERLESS END SUCTION AND SIDE SUCTION AIR CONDITIONING PUMPS COST LESS—LAST LONGER



AquaLine



Fluidyne

PEERLESS AQUALINE® Pumps are available in sizes to 8-inches. Capacities to 2600 gpm, heads to 280 feet. Temperatures to 250°F. Horizontal split case design allows quick inspection without disturbing piping.

PEERLESS FLUIDYNE® Pumps are compact end-suction design. Redi-Packed in 22 sizes from 1 x 2 x 6 to 2½ x 3 x 10, for immediate shipment. Heads to 230 feet, capacities to 300 gpm, motors from 1 to 15 hp.

If there is a key word to describe Peerless Pumps, that word is QUALITY. You'll find it in the way the pumps are designed. You'll find it in the way the pumps are made. And you'll find it most apparent in the way these pumps operate. Remarkably long trouble-free operating records are routine with these better-made pumps.

But QUALITY is just the start of a long list of important features that recommend the Peerless AquaLine and Fluidyne line of pumps for your water handling jobs. There's immediate availability from ready-to-ship stocks. Complete hydraulic coverage for every type of application. Compact streamlined design that gives you space-saving good-looking layouts. And fast, on-time service from a network of warehouses and field offices. Get the full story of these superior pumps. Request more information today.

ATTENTION DEALERS: A limited number of Peerless AquaLine and Fluidyne pump dealerships are available. Please write for complete information.

Putting Ideas to Work

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

Peerless Pump Division

Offices:

New York; Detroit; Cleveland; Chicago; Indianapolis; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno.

Distributors in principal cities.

Consult your telephone directory.

PEERLESS PUMP DIVISION, FOOD MACHINERY AND CHEMICAL CORPORATION
2005 Northwestern Avenue, Indianapolis 8, Indiana

Gentlemen: Please send me immediately:

- ☐ Bulletin B-2319 on Peerless Fluidyne Pumps.
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- ☐ Name and address of nearest Peerless Dealer.

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HPAC

SPECIFY A *Proven* SUBMERSIBLE PUMP

SPECIFY "weil"

weil Submersible Sewage and Sump Pumps have been in use since 1951. There is no substitute for experience.

NOW AVAILABLE in a choice of two motors

1750 R.P.M. and Low Speed 1140 R.P.M. for longer life, less wear and improved non-clog characteristics.

NOW AVAILABLE with a choice of two controls

Conventional float switch

MICRO Pressure switch (as illustrated)

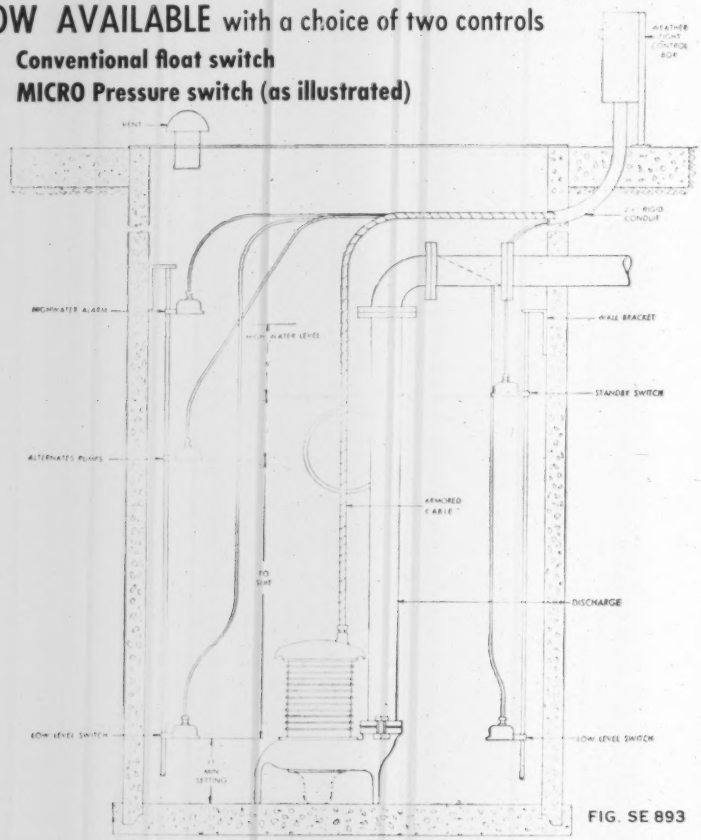

FIG. SE 893

Illustrated is a Duplex Installation of two **weil** Submersible Sewage Pumps employing MICRO Switch controls to start and stop pumps; to alternate pumps; and to provide for high water alarm. Note the ease with which switches are positioned (or changed) to control water levels. The Submersible MICRO Switch has no exposed moving parts, needs no servicing and coupled with the **weil** Submersible Pump provides an extremely efficient non-clog trouble-free pumping system.

weil Submersible Pumps are manufactured in discharge sizes of 3" to 6" and capacities to 2000 G.P.M. There is a **weil** Submersible Pump to meet all requirements. **Now approved by the CANADIAN STANDARD ASSOCIATION Testing Laboratories.**

Send for Bulletins SE-860 and SE 865 for complete engineering information.

weil PUMP COMPANY

1514 North Fremont St. • Chicago 22, Ill.

EQUIPMENT DEVELOPMENTS

Continued

Water Analyzer . . .

. . .for water conditioning applications—*Technicon Controls, Inc., Dept. HPAC, Chauncey, N. Y.*

"Autoanalyzer" is photoelectric colorimeter equipped with automatic devices to provide continuous sampling, addition of chemical reagents, separation of impurities, mixing, measuring of color and recording or results.

Push-Button Stations . . .

. . .designed for flush wall mounting—*General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

Stainless steel plated, flush-mounted stations, rated at 10 amp carry, 600 volts maximum, designed for control of magnetic motor starters and contactors; will fit any standard single-gang outlet box.

Light Ball Bearings . . .

. . .in wide selection of sizes, types—*Hoover Ball and Bearing Co., Dept. HPAC, 5400 S. State Rd., Ann Arbor, Mich.*

"3L00" extra light series ball bearings available in open, single or double shield, or single or double contact seal and combination contact seal and shield, other types provided with or without a snap ring. Shaft sizes are from 17 to 65 mm.

Hacksaw Blades . . .

. . .developed to provide cutting speed, accuracy, durability—*Tyler Mfg. Co., Inc., Dept. HPAC, 1005 W. Arbor Vitae Ave., Inglewood 2, Calif.*

Flat hacksaw blades of tempered Swedish tungsten alloy steel available in 10 or 12 in. lengths with choice of 18, 24 or 32 teeth per in. Blades packaged 100 per box.

Plastic Welding Rod . . .

. . .packaged in tubes containing 2½, 5, 25 lb of material—*Laramy Products Co., Dept. HPAC, Box 8, Hingham, Mass.*

Plastic welding rod available in three diameters: ⅛, 5/32, 5/16

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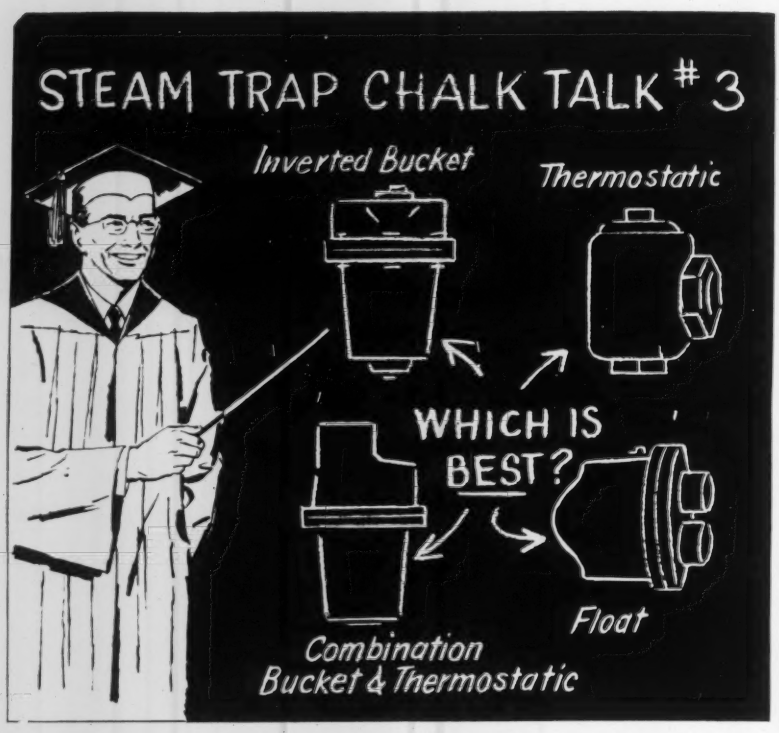

Is one trap design better than another?

- The steam trap user is often confused by the fact that there are four different designs of traps on the market. Is one better than another, and if so, which one should he use?

Actually, each design of trap has its place, *depending upon the application.* For example, thermostatic traps are preferred for chemical, petroleum and other outdoor applications because they cannot freeze. However, they do not compare in efficiency with inverted bucket traps for normal inside use. Where fast heating up is required, the combination bucket and thermostatic trap permits steam units to reach maximum heat 2½ times faster. For continuous service, float traps are best.

For sound recommendations, ask Anderson. Manufacturing a complete line of traps, in all designs, they give unbiased counsel. Their engineering catalog, "How to Select Steam Traps and Other Fluid Specialties" contains hundreds of worthwhile recommendations. Mail coupon for your copy today.

A TRAP FOR EVERY PURPOSE

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ANDERSON SUPER•SILVERTOPS

EQUIPMENT DEVELOPMENTS
Continued

in. in 48 in. straight lengths carried in stock for welding types I and II PVC. Linear Polyethylene rod available in ⅛ in. only.

Air Filter Adhesive . . .

. . . Now available in two types of spray containers—*Research Products Corp., Dept. HPAC,* 1015 *W. Washington Ave., Madison* 10, *Wis.*

"Super Filter Coat" adhesive available in "HandiKoter" container with self-contained, finger operated spray pump, and "Pressure Koter" pressurized sprayer. Both contain 1 pt of adhesive.

Motor Starter . . .

. . . Designed to fit any standard single-gang outlet box—*General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

Key operated, manual, single-phase 115/230 volt starter designed for direct operation of motors up to and including 1 hp. Available in single or double pole design in open or NEMA type 1 surface mounted enclosures.

Hot Water Heaters . . .

. . . Designed to meet requirements for small commercial applications—*Carlin Co., Dept. HPAC,* 912 *Silas Deane Hwy., Wethersfield* 9, *Conn.*

New units available in 65 and 70 gal storage capacities, copper and glass lined, respectively.

Plastic Tube Pilots . . .

. . . Designed for use with heat exchanger and boiler tubes from ⅜ to 1 in. OD—*Thomas C. Wilson, Inc., Dept. HPAC,* 21-11 *44th Ave., Long Island City, N. Y.*

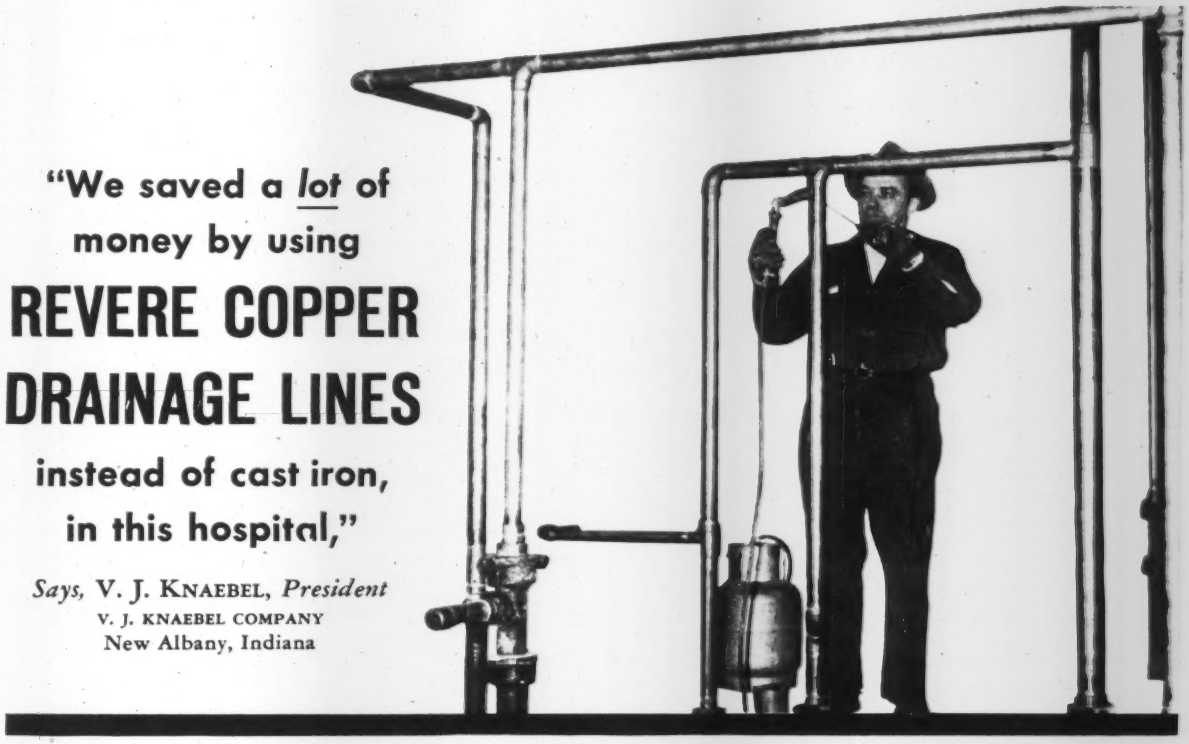
Plastic tube pilots used to speed assembly of tubular equipment by piloting tubes through tube sheets, baffles, support plates. Piloting said to prevent damage to tube ends.

"We saved a *lot* of money by using

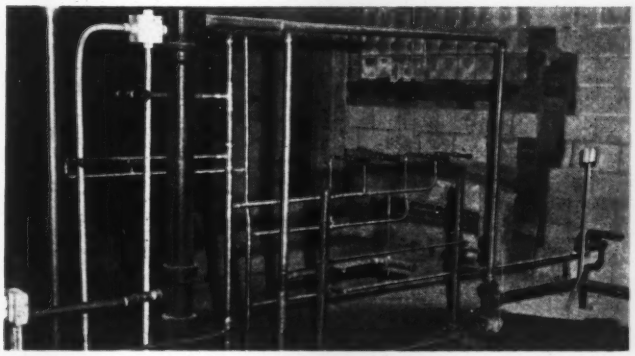
REVERE COPPER DRAINAGE LINES

instead of cast iron, in this hospital,"

Says, V. J. KNAEBEL, *President*
V. J. KNAEBEL COMPANY
New Albany, Indiana



CLARK COUNTY MEMORIAL HOSPITAL, Jeffersonville, Indiana. *Architect:* WALKER, APPLEGATE, OAKES & RITZ, New Albany, Ind. *Engineer:* SOUTHERN ENGINEERING CO., Louisville, Ky. *Gen. Cont.:* JOHN WILE CONSTRUCTION CO., Louisville, Ky.



ROUGHING IN of typical room showing Revere Copper Drainage Lines, Hot-Cold Water and Type "K" Oxygen Lines. 40,000 lbs. of Revere Copper Water Tube were used for drainage lines, oxygen and hot-cold water lines, heating and cooling mains, control lines for room air conditioning units, recirculating water to the cooling tower and other applications.

The original specification on this job called for cast iron drainage lines. When Mr. Knaebel of the V. J. Knaebel Company looked over the specifications, he told the engineer that he would install Revere Type DWV Tube in place of the cast iron at no extra charge. For his past experience has proved to him that a better job can be done, and that a great deal of money could be saved by the use of copper. This is how Mr. Knaebel put it:

"When you consider the longer lengths of copper drainage lines, how easy it is to solder a joint, the lightness in handling and how you can prefabricate sections in the shop, it's only logical that you can save money by using copper. And, in drainage and waste line use I have yet to hear of any trouble due to clogging.

"Copper water tube is equally efficient and economical when used for hot and cold water lines, air conditioning and oxygen lines, radiant panel heating and other uses. Nothing takes the place of copper water tube for economical, trouble-free performance. And, with the leak-proof joints you can get with copper, coupled with its non-rusting qualities, you seldom, if ever, have to worry about call-backs."

Contractor after contractor will tell you the same thing, "Copper Water Tube costs less to install than rustable materials." For the sake of cost, for the sake of your reputation, specify an all-copper job, using Revere, the oldest name in copper. Your Revere Distributor will fill *all* your needs.

REVERE COPPER AND BRASS INCORPORATED

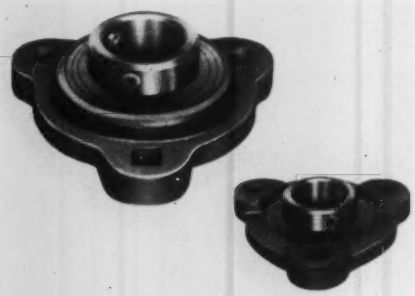
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities. Distributors Everywhere.

EQUIPMENT DEVELOPMENTS

Continued



Flanged Bearings . . .

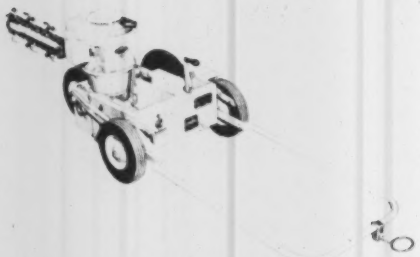
. . . available in two models—*Sealmaster Bearing Div., Stephens-Adamson Mfg. Co., Dept. HPAC, Ridgeway Ave., Aurora, Ill.*

New "L Type Series" offers "LF" three-bolt and "LFT" two-bolt flange bearing units. Regular "L" bearing cartridge with spherical outside diameter is permanently mounted in one piece malleable housing. Units come prelubricated, and available in following sizes: 3/4, 7/8, 15/16, 1, 1 1/8, 1 3/16, 1 1/4, 1 5/16, 1 3/8, 1 7/16 in.

Portable Grinder . . .

. . . in new series consisting of 4 in. heavy duty horizontal grinders, wire brushing machines, horizontal buffers—*Thomas C. Wilson, Inc., Dept. HPAC, 21-11 44th Ave., Long Island City, N. Y.*

Grinders, wire brushing machines in "902 Series" of portable grinders offers choice of three speeds: 12,000, 9000, or 7200 rpm. Horizontal buffers have spindle 1 in. longer than that of grinders, wire brushing machines; available in 12,000 or 9000 rpm speeds.

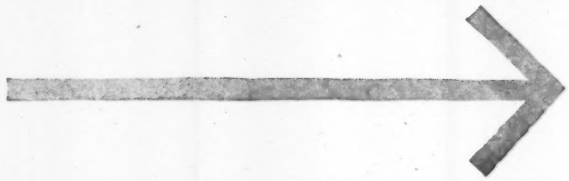


Portable Trencher . . .

. . . for installing gas and water lines or sprinkling systems — *Davis Mfg., Inc., Dept. HPAC, 1301 S. Handley, Wichita, Kan.*

Trenches from 2 to 3 in. wide with depths of 3 ft with no operator needed once started. Have six speed settings and can attain speeds up to 400 ft per hr. Adjust to desired depth with screw-type, self-locking depth control crank.

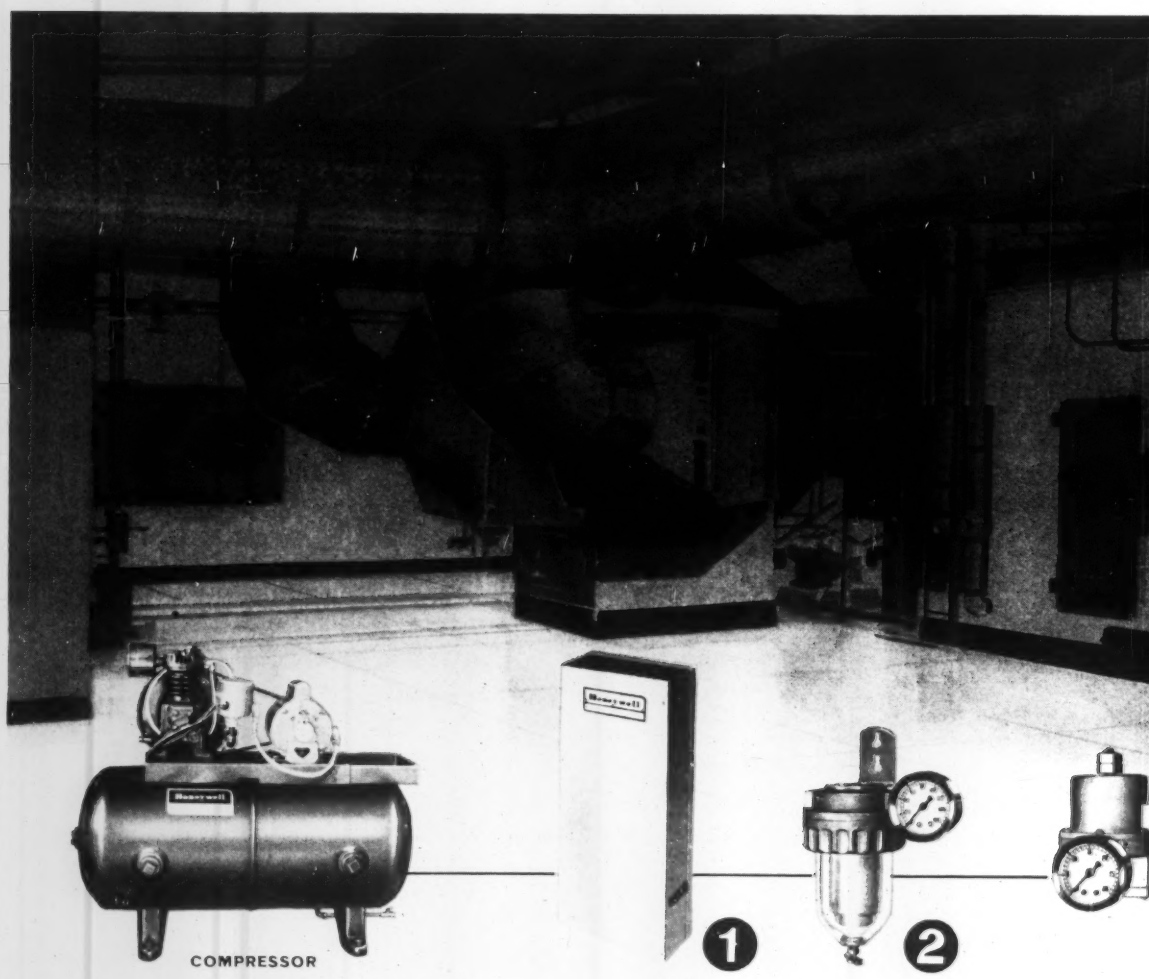
YOUR IDEAS WORK BETTER WHEN YOU WORK WITH HONEYWELL



THE FOLLOWING pages bring you some of the latest developments in automatic controls from Honeywell. They widen your choice of products; give you more to work with.

For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 sales offices throughout the country. Each is staffed with control specialists to assist you in writing specifications and preparing control layouts.

Now you can maintain stability, po
performance in Central Fan Contro



Protect your pneumatic control system with Honeywell's Dryer, Filter & PRV Station

To maintain top performance and avoid corrosion in your pneumatic control system, the air must be properly cleaned and dried, with its pressure reduced to the exact control pressure. These new Honeywell products assure continuing top performance by protecting your precision pneumatic controls from corrosion and dirt. This assures you of a longer, trouble-free life from your pneumatic control system.

With the largest field force in the industry—in 112 offices across the country—Honeywell gives the most convenient, prompt, efficient service.

Specify the entire line of Honeywell pneumatic controls . . . the very finest in the world. For more information, call your nearest Honeywell office, or write to Minneapolis-Honeywell, Department AC-9-132, Minneapolis 8, Minnesota.

1 New
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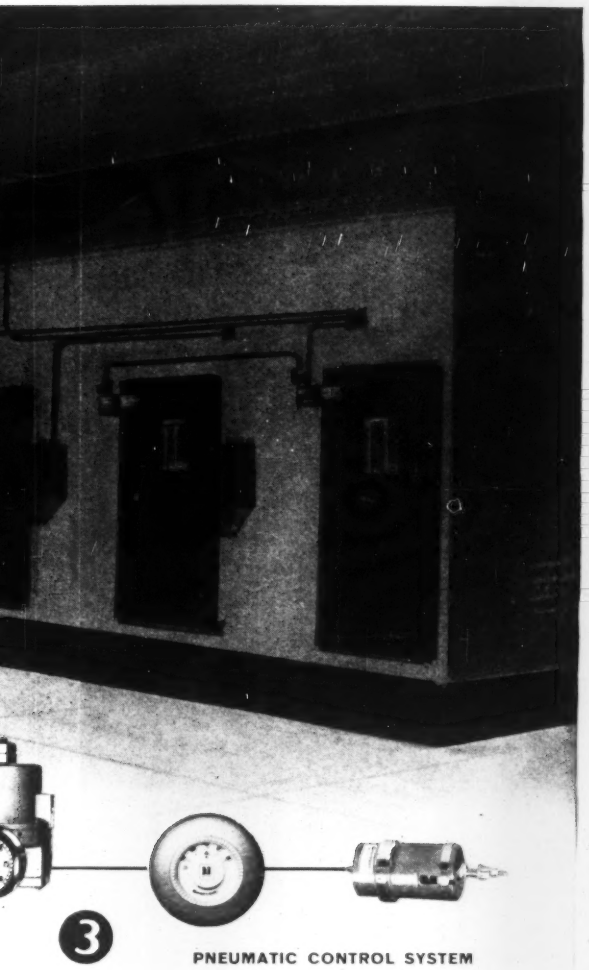


PNEUMATIC CONTROL SYSTEM

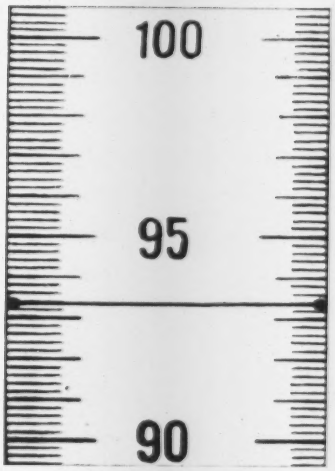
New Automatic Air Dryer—An exclusive from Honeywell! ctively extracts all damaging moisture from the compressed air lied to the pneumatic control system. Requires virtually no ntenance. Two fully automatic drying tanks work interchangeably.

New Filter—Highly efficient new filter removes all dirt and oil the high pressure air. Has a transparent housing and a replace- filter element, so you can check visually to see when it needs ing.

New Pressure Reducing Valve Station—Maintains ource of control air at the precise pressure regardless of the drain he system. Built-in safety pressure relief valve can be adjusted he desired safe operating pressure of the downstream line. PRV on will automatically bleed off the pressure difference when ched from one pressure system to another.

Check your fan system's temperatures accurately—with

HONEYWELL'S ELECTRONIC INDICATOR



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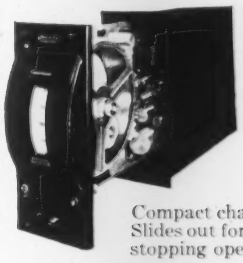


Compact chassis only 6 1/2" wide. Slides out for inspection without stopping operation of indicator.

With this new, compact indicator, the operating engineer can remotely read temperatures at any point in a central fan system simply by pressing a button. And he gets the most accurate readings used in air conditioning. Honeywell's indicator can be read to plus or minus 1/5 of a degree.

Central fan system temperatures can all be checked instantly on this one instrument in less than a square foot of panel space. Sensing elements are connected to the indicator by low voltage wiring.

At little extra cost, a Honeywell Systems Analyzer can be added when desired. Using the same wiring and sensing elements as the indicator, it records, on a 12-inch wide strip chart, the readings for any points or combination of points providing a permanent record.

Honeywell's new Selectographic DataCenter* features modular design!

It simplifies application, adds new economy to centralized control!

THE HONEYWELL DataCenter lets one man do the work of a crew—set temperatures, make adjustments, supervise critical areas of an entire building's air conditioning system from one central location.

And Honeywell's modular building block design gives greater economy, new flexibility. Starting with the basic unit—the central Selectographic Console—modules of a standard 2′ by 2′ dimension may be added as the need arises or as budget permits. Honeywell's Selectographic DataCenter can be installed in buildings of all sizes, for all purposes; can grow with your needs.

For more information about this panel, call your local Honeywell office. Or write Honeywell, Dept. AC-9-92, Minneapolis 8, Minnesota.

*Trademark

FOR MORE TO WORK WITH WORK WITH HONEYWELL

Honeywell

First in Control

RECENT TRADE LITERATURE...

▶ *AIR CLEANING*—New brochure "234-P1" discusses and illustrates requirements in steel mill operations. Also considered in 16 page booklet are air filter locations, recommended sizes and types of filters for particular applications, dust problems, maintenance and ventilation problems. *American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8, Ky.*

▶ *AIR CONDITIONING*—and refrigeration 300 page catalog recently released contains illustrations and is very complete, according to manufacturer. May be obtained by writing on company letterhead to: *Budlock Refrigeration Supply Co., Inc., Dept. HPAC, 434 Carpenter St., Evansville, Ind.*

▶ *AIR CONDITIONING PUMPS*—information available in bulletin "2000-B3" describing in detail how to select proper pump. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

▶ *AIR CONDITIONING UNITS*—are featured in detail in new 58 page bulletin containing illustrations, photos, and charts of capacities, engineering data, dimensions, and specifications of models of various types and styles. *Airfan Engineering Co., Dept. HPAC, 7401 Telegraph Rd., Los Angeles 22.*

▶ *AIR CONDITIONING UNITS*—for multi-room buildings are presented in brochure "9127" which includes information on heating coil capacities, gravity heating capacity, hot water and steam heating capacity, and water friction for various air volumes. *American-Standard Industrial Div., Dept. HPAC, Detroit 32, Mich.*

▶ *AIR COOLED CONDENSER*—requiring no motors, fans, water, or maintenance is featured in new manual which includes detailed explanation of operating principle, operating advantages, installation instructions, trade prices. *Edwards Engineering Corp., Dept. HPAC, 101 Alexander Ave., Pompton Plains, N.J.*

▶ *AIR FILTRATION*—Illustrated catalog gives details on manufacturer's complete line of air filtration equipment. Complete set of graphs, tables, charts show capacities, dimensions, specifications of each item. Models are shown in photos, engineering drawings. *Flanders Filters, Inc., Dept. HPAC, Riverhead, L. I., N. Y.*

▶ *AIR-OVER FAN MOTOR*—designed for operation in ventilating systems, exhaust systems, cooling towers, and all air moving installations where motor drives propeller or axial flow fan. Described in bulletin No. "2950" including motor dimensions and data on recommended maximum fan weight, thrust, and location. *Louis Allis Co., Dept. HPAC, 427 E. Stewart St., Milwaukee 1, Wisc.*

▶ *ALUMINUM FOIL*—New 26 page booklet presents range of uses for material in architectural, electrical, heating and cooling, other applications. Publication is illustrated. *Aluminum Co. of America, Dept. HPAC, 782 Alcoa Bldg., Pittsburgh 19.*

▶ *ALUMINUM WELDING*—discussed in new 120 page book, "ADI 1258", covering entire subject from a brief historical note on first uses of processes for welding aluminum to highly specialized aluminum fabrications as welded with them today. *Air Reduction Sales Co., Dept. HPAC, 150 E. 42nd St., New York 17.*

▶ *ANCHORS, STRAPS*—Pocket size "Catalog No. 100" presents manufacturer's line of anchors, straps, other mechanical installation accessories. Each item illustrated, described; specifications given in tables. *Holub Industries, Inc., Dept. HPAC, Sycamore, Ill.*

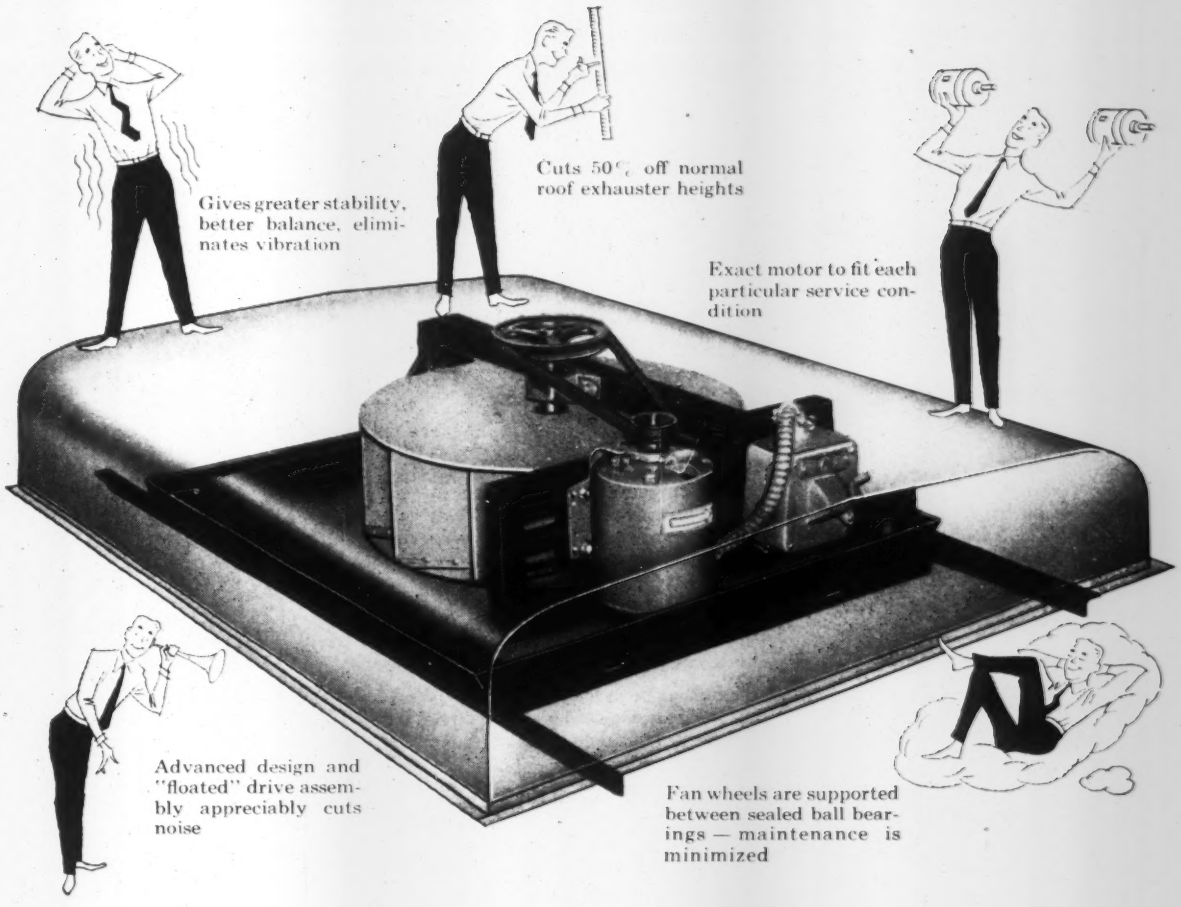
▶ *ARC WELDING CONNECTIONS*—illustrated and described in new catalog No. "12" containing specifications and prices for both connections and accessories. *Tweco Products, Inc., Dept. HPAC, Box 666, Wichita, Kan.*

▶ *BALANCING MACHINE*—in three horizontal and two vertical models is discussed in new catalog and data sheets which include capacities and specifications for each. *Bear Mfg. Co., Industrial Div., Dept. HPAC, 2030 5th Ave., Rock Island, Ill.*

▶ *BEARINGS*—information provided in bulletin "110" which includes dimensions, loads and other application data for deep-groove bearings. *Hoover Ball & Bearing Co., Dept. HPAC, 5400 S. State Road, Ann Arbor, Mich.*

It's what you can't see that's important!

PENN VENTILATOR'S TRULY LOW-CONTOUR DYNAFAN


Gives greater stability, better balance, eliminates vibration
Cuts 50% off normal roof exhauster heights
Exact motor to fit each particular service condition
Advanced design and "floated" drive assembly appreciably cuts noise
Fan wheels are supported between sealed ball bearings — maintenance is minimized

The highest quality and unobtrusive appearance are yours when you use the Low-Contour Dynafan roof exhauster. Identical housing designs are available for both supply and relief units, also. The Penn Ventilator man in your area can give you complete details. Call him . . . today.

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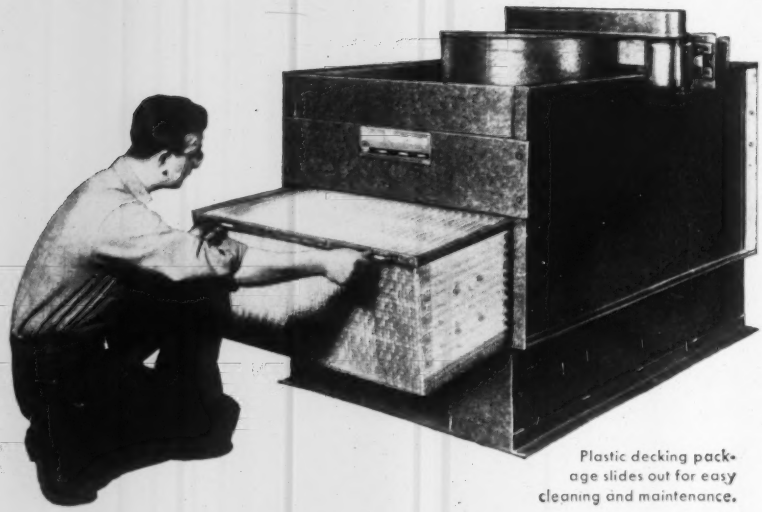


Plastic decking package slides out for easy cleaning and maintenance.

Binks new Watertemp cooling tower gives you advanced tower features at low installed cost

Binks WATERTEMP cooling tower packs high cooling efficiency into a package that makes sense in original installed cost and long-haul maintenance.

Fast, simple assembly

You need only a simple mounting foundation. Sub-assemblies need only a wrench . . . work goes fast.

Needs no paint

The only weatherproofing coating needed is already on the tower when shipped. All parts have been hot-dip galvanized after fabrication. A special galvanizing process deposits a thicker coating than established as standard by Federal and A.S.T.M. specifications.

Easy to maintain

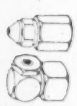
There are no spray nozzles to clean. The plastic decking is practically indestructible . . . and the decking package slides completely out of the tower. Decking clean-up is easy and the whole tower interior is exposed for maintenance.

Economical 3 ways

Original price is low. Easy installation holds costs down, too. Maintenance takes little time.

Send for free Bulletin WT 501

See how the many WATERTEMP features let you specify big tower performance and still keep quotes down. Bulletin contains complete specifications. Get your copy from your nearest Binks Branch Office or write direct.



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EVERYTHING FOR WATER COOLING

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

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RECENT TRADE LITERATURE
Continued

▸ *BUTTERFLY VALVES*—Applications and details are described in new brochure which includes construction features, methods of control and allowable pressure drops for seven classes of valves in sizes ranging from 3 to 48 in. *W. S. Rockwell Co., Dept. HPAC, 200 Eliot St., Fairfield, Conn.*

▸ *CABINET UNIT HEATERS*—are presented in bulletin No. "351" which includes illustrations of general and mechanical design as well as charts and tables for steam and hot water capacity ratings. *McQuay, Inc., Dept. HPAC, 1600 Broadway St. N. E., Minneapolis 13.*

▸ *CARBON STEEL TUBING*—design data for heat transfer equipment is furnished in bulletin "TDC-142B" giving information on various fabrication operations as well as mechanical and physical properties. *Babcock & Wilcox Co., Tubular Products Div., 712 Eleventh St., Beaver Falls, Pa.*

▸ *CENTRAL STATION AIR CONDITIONING*—New 76 page, illustrated catalog, "Bulletin 9227," describes company's line of low pressure and high pressure central station air conditioners. Design features, construction details, cooling and heating coils and accessories discussed, illustrated. *American-Standard, Industrial Div., Dept. HPAC, Detroit 32.*

▸ *CHEMICAL FEEDER*—for low cost controlled feeding of water treatment chemicals into small water systems in bulletin No. "1913.20A-1" containing operational data and line drawing showing dimensions. *B-I-F Industries, Inc., Dept. HPAC, 345 Harris Ave., Providence 1, R.I.*

FICTION and FACT

FICTION:

Removal of odors from the air requires bulky, expensive equipment—necessitating larger fans and motors to overcome resistance.

FACT:

R P Super Filter Coat, applied to R P Aluminum Filters, automatically removes both dust and odors, with no other equipment required.

RP®

Multi-Velocity Industrial AIR FILTERS

When you specify R P Industrial Filters, you gain the tremendous advantage of inexpensive, automatic odor-removal through the use of R P Super Filter Coat water soluble adhesive. Odors are actually removed from the air stream by absorption, held by the adhesive, and prevented from re-circulating. It is *NOT* a simple masking process—it's true, positive odor-removal. Through the reduction in make-up air requirements possible with this true odor removal, reductions in the size of heating and cooling equipment and in operating costs are available. And this important odor-removing function is, of course, a plus feature—in addition to effective dust removing properties and the like-new efficiency restored to the filter after washing and re-coating.

Permanent-type light weight, rugged, aluminum R P Industrial Filters have other advantages too. Their light weight makes them easier to handle and wash; eliminates heavy structural design in filter bank construction; reduces operating and maintenance cost through longer service life and easier handling. Write for complete information on the benefits of R P Industrial Air Filters.

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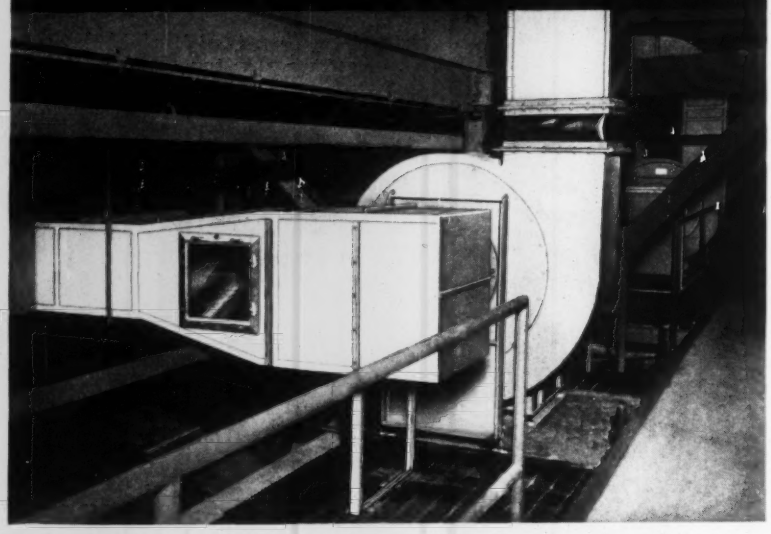
RESEARCH PRODUCTS *Corporation*

Dept. 46, Madison 10, Wisconsin

problem: **Corrosive Acid Fumes**

solution: **Van-Cor Exhaust Duct System**



OVER 50,000 SQ. FT. OF VAN-COR SHEET AND JOINING STRIPS remove all acid, plating and cleaning fumes throughout the Allentown (Pa.) Works of Western Electric Co. Corrosion is stopped in its tracks because Van-Cor unplasticized PVC is resistant to scores of acids, alkalies and salts.

Although the contractor was unfamiliar with plastics fabrication, he was able to assemble the components of this system on the job site at a substantial savings over installation of prefabricated components. This savings was made possible through the use of Van-Cor joining strips.

VAN-COR FABRICATIONS, PIPE, FITTINGS, VALVES, CONDUITS offer *you* these advantages:

1. *Resist Corrosion of Industrial Acids & Alkalies*
2. *Light in Weight (⅙ that of Aluminum)*
3. *Easily Installed; High Tensile Strength; Low Flow Resistance*
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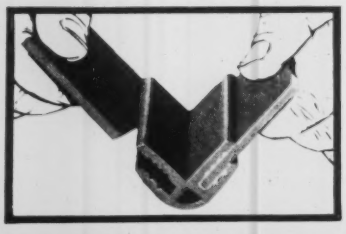

Van-Cor 90° and H Joining Strips
The fast, low-cost way
to connect PVC sheet stock.

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COLONIAL PLASTICS MFG. CO.
Subsidiary of THE VAN DORN IRON WORKS CO.
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RECENT TRADE LITERATURE
Continued

▸ *COIL PANELS*—made of two sheets of metal, either single embossed or double embossed with embossing forming flow channels for steam, water, oil, refrigerant, etc. Featured in work sheets Nos. 58 and 59 which include a total of 62 variations. *Dean Thermo-Panel Coil Div., Dept. HPAC, 616 Franklin Ave., Brooklyn 38, N.Y.*

▸ *CONDENSATE CONTROL*—"C-B" system of condensate control explained in brochure ("Publication 6001-B"). Brochure offers wide range of case histories, installation stories. *Cochrane Corp., Dept. HPAC, 17th St. below Allegheny Ave., Philadelphia 32.*

▸ *CONDENSATE DRAINERS*—and method of operation of continuous discharge drainers are discussed in bulletin "5201-A" along with applications and capacities. Drainers described in bulletin are of all-float-actuated rotary valve design and are recommended by manufacturer for steam, compressed air and gas service. Capacities range from 100 to 500,000 lb of condensate per hr. *Cochrane Corp., Dept. HPAC, 17th St. below Allegheny Ave., Philadelphia 32.*

▸ *CONDENSATE PUMPS*—New 12 page catalog describes four different types of vacuum return line condensate pumps for heating systems. Booklet contains typical specifications, complete dimensions, installation diagrams, cutaway three-dimensional drawings illustrating operating characteristics. *C. H. Wheeler Mfg. Co., Dept. HPAC, 19th and Lehigh Ave., Philadelphia 32.*

▸ *CONDENSING UNIT*—data contained in two new booklets — one on package liquid coolers (SD-704-CA) — the other on condensing units and

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More than 100,000 Gallaher Air-Vans Have Been Installed.

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Three Enterprise Burners, each rated 330 HP, provide dependable heat for the Builders Building's half-million square feet of space.

Users, Engineers, Contractors—all agree:

"Enterprise is first choice of heating experts"

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This is typical of Enterprise Burner performance. Whatever your heavy duty commercial or industrial application, look to Enterprise for the finest in a complete range of oil and combination oil and gas burners from 4 to 200 gph. Complete information and illustrated specification sheets available on request.

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RECENT TRADE LITERATURE

Continued

motor compressors (SD-714-CA). *Bell & Gossett Co., Dept. HPAC, 8200 N. Austin, Morton Grove, Ill.*

▸ *CONTROL VALVES*—for use in pulp and paper making processes described in bulletin "MD-1" which contains data on application, operation, and terms. *Conflow Corp., Dept. HPAC, 2100 Arch St., Philadelphia 3.*

▸ *CONTROLS AND SWITCHES*—described in new supplementary bulletins on electromagnetic control developments as featured in catalog "57-S". *Automatic Switch Co., Dept. HPAC, Florham Park, N.J.*

▸ *CO_2 WELDING*—is discussed in new 24 page catalog "ADE 882" containing three sections: how both conventional and dip transfer welding are applied to specific jobs; descriptions of outstanding characteristics; equipment used in carbon dioxide welding. *Air Reduction Sales Co., Dept. HPAC, 150 E. 42nd St., New York 17.*

▸ *CONVECTOR-RADIATORS*—for steam and hot water heating listed in new data catalog "2328" providing specification, capacity information, and dimensions. *Young Radiator Co., Dept. HPAC, 709 S. Marquette St., Racine, Wisc.*

▸ *CONVERSION TABLE*—for converting inches and fraction of inches into decimal parts of a foot is available in "TDC-110". Suitable for application to steel tubing and many other purposes. *Babcock & Wilcox Co., Dept. HPAC, 712 Eleventh St., Beaver Falls, Pa.*

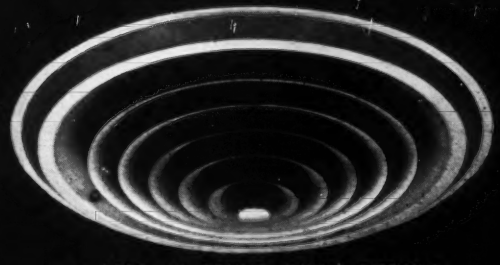
▸ *DAMPERS AND LOUVERS*—for general construction, heating, ventilating, and air conditioning illustrated in new catalog along with specifications. *Arrow Louver & Damper Corp., Dept. HPAC, 72 Berry St., Brooklyn 11, N.Y.*

The BEST ENGINEERED DIFFUSERS for CEILING, SIDEWALL *and now*—BASE!

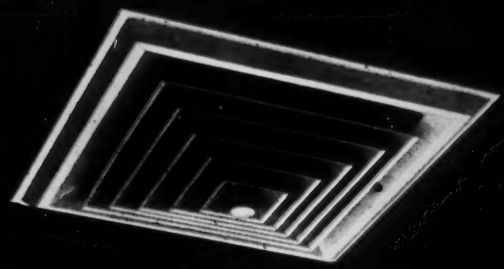
The HIGHEST QUALITY — The MOST COMPLETE LINES — From The Industry's FINEST Facility.

The No. 1500 ROUND CEILING DIFFUSER **The No. 2500 SQUARE CEILING Diffuser**

REALLY "The BEST For LESS"—DESIGNED To COMPARE with Higher Priced LINES.



No. 1500 U.S. ROUND CEILING DIFFUSER

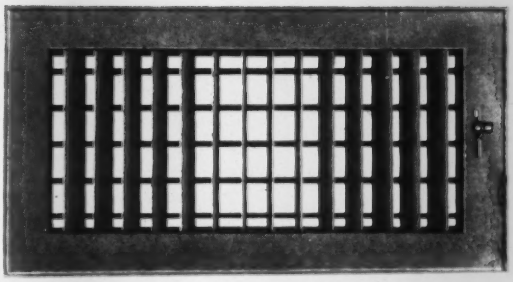


No. 2500 U.S. SQUARE CEILING DIFFUSER

Both No. 1500 Round and No. 2500 U.S. Square CEILING DIFFUSERS May be Equipped with the Smoothest and Most PERFECT Knob-Operated Bi-Valve Damper—An Original U.S. FEATURE.

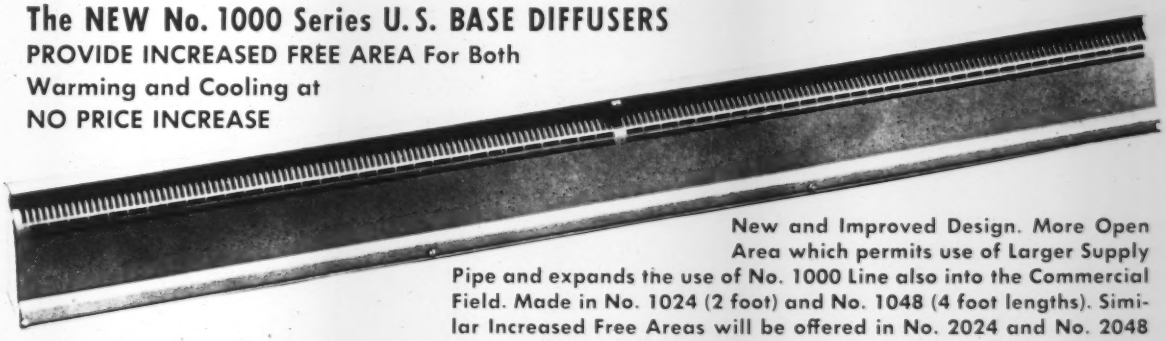
No. 192-L Multi-Flex AIR CONDITIONING REGISTER

Rear Lever-Operated Valves Regulate Up-and-Down Directional Flows for RAPID change-overs from warm to cool air conditioning needs. Individually-set double-edge grille bars provide perfect lateral diffusion. Depth of Valve Assembly Sufficiently Shallow for Setting in Standard Depth Stud Partitions. Can be used in Ceiling or Wall Locations. Very Low PRICE. Compare with others.



The NEW No. 1000 Series U.S. BASE DIFFUSERS

PROVIDE INCREASED FREE AREA For Both Warming and Cooling at NO PRICE INCREASE



New and Improved Design. More Open Area which permits use of Larger Supply Pipe and expands the use of No. 1000 Line also into the Commercial Field. Made in No. 1024 (2 foot) and No. 1048 (4 foot lengths). Similar Increased Free Areas will be offered in No. 2024 and No. 2048 U.S. Perimeter Intakes.

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OWNER: Esso Research and Engineering Co., Linden, N. J. **ARCHITECT AND ENGINEER:** Voorhees, Walker, Smith and Smith, New York, N. Y. **GENERAL CONTRACTOR:** Frank Briscoe Co., Paterson N. J. **MECHANICAL PIPING CONTRACTOR:** Frank A. McBride Co., Paterson, N. J.

- Because Fairbanks Valves are Quality—DEPENDABLE—products.
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RECENT TRADE LITERATURE
Continued

▸ *DUST AND FUME CONTROL*—Sixty different plant installations from wide range of industries are illustrated, described in new 52 page catalog showing applications of company's dust and fume control systems. Design, fabrication, installation of systems covered in brochure. *Kirk & Blum Mfg. Co., Dept. HPAC, 3130 Forrer St., Cincinnati 9.*

▸ *DUST COLLECTOR*—discussed in new bulletin "291A" which describes characteristics and operation of centrifugal dry type unit designed to handle large exhaust volumes of granular dust. Charts, schematic drawings, and dimensional data included. *American Air Filter Co., Dept. HPAC, 215 Central Ave., Louisville 8, Ky.*

▸ *DUST CONTROL*—literature showing how to protect machinery investment, product quality, employee health, reduce maintenance costs with effective dust control. *Torit Mfg. Co., Dept. HPAC, Walnut & Exchange Sts., St. Paul, Minn.*

▸ *DIRECT EXPANSION COILS*—their construction features as well as information on proper coil selection are described in catalog No. "405" which includes rating tables and psychrometric tables and charts. *McQuay, Inc., Dept. HPAC, 1600 Broadway St. N.E., Minneapolis 13.*

▸ *DIAMOND DRILLING EQUIPMENT*—New product information sheet describes new developments in "Trueco" portable and mobile diamond drilling equipment. New products illustrated, described. *Masonry Drilling Div., Wheel Trueing Tool Co., 3400-182 W. Davison, Detroit 38.*

▸ *DIAPHRAGM CONTROL VALVE*—New bulletin "J-170" describes

National Bank of Detroit

Outstanding example of Detroit's new "Airy" downtown plan . . .

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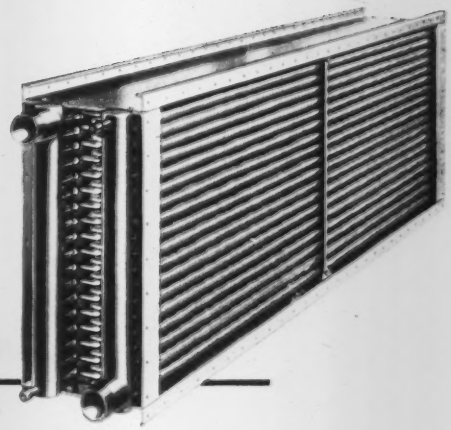
Aerofin's modern SMOOTH FIN design permits use of high air velocities without turbulence or excessive resistance – provides ample heat-exchange capacity in limited space.

You can safely specify Aerofin coils at full published ratings. Aerofin performance data are laboratory and field proved.



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Aerofin is sold only by manufacturers of fan system apparatus. List on request.

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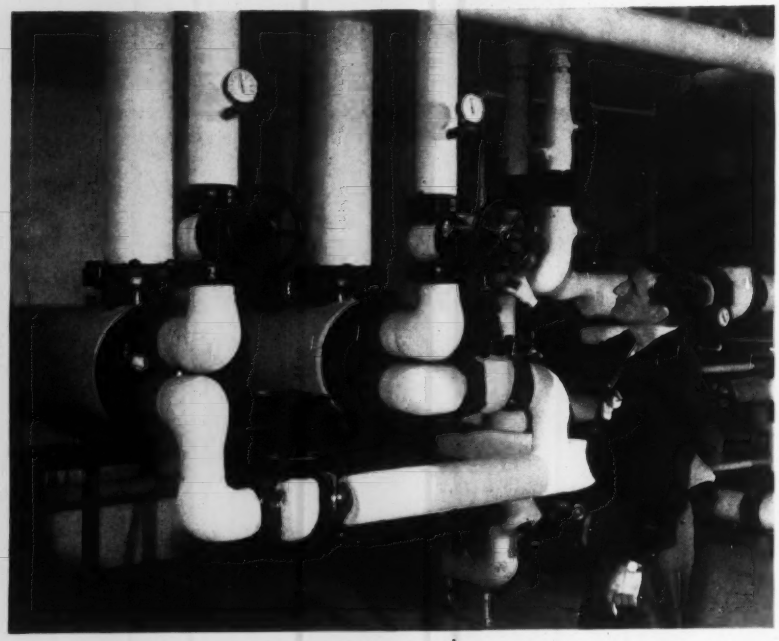
GENERAL converters provide CLOSE HEAT CONTROL



At AVCO's new Research Center, **GENERAL** units meet individual heating requirements of multi-building complex!

Research & Advanced Development Division
AVCO Manufacturing Corp.
WILMINGTON, MASS.
Engineers: METCALF & EDDY Boston, Mass.
Contractor: FRED WILLIAMS, INC. Boston, Mass.
Architect: PEREIRA AND LUCKMAN Los Angeles, California
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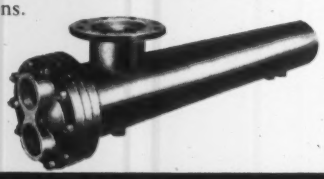
Each building in AVCO's spacious new Research and Development Center is equipped with its own set of steam to hot water converters. Twelve converters, operating on steam from a main boiler room, provide maximum radiation efficiency, better utilization of space, and closer heat control. Extremely close temperature control required in some heating zones is accomplished without critical adjustment or complex equipment.

Compact General converters permit maximum installation flexibility . . . require minimum piping. There's a General application-rated unit designed to meet your exact radiation or space heating requirements . . . from 1 to 1800 gpm . . . in 4" to 28" diameter sizes. Request Bulletin 63A and see why General converters were selected for some of the country's largest installations.



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EAST GREENWICH · RHODE ISLAND

RECENT TRADE LITERATURE
Continued

sliding gate and plate control valves available from manufacturer. Complete engineering data, cutaway drawings, features, application information, dimensional drawings, flow capacities, rating charts, flow curves, sample specifications all included in publication. *Jordan Div., OPB Corp., Dept. HPAC, 6013 Wiehe Rd., Cincinnati 13.*

▸ *DUCT FAN*—Illustrated "Bulletin "A-114A" describes line of belt-drive duct fans with adjustable driver sheaves. Fans available in sizes from 12 to 60 in. Booklet contains photos, dimensional drawings, tables, charts of specifications and other data. *Hartzell Propeller Fan Co., Dept. HPAC, Piqua, Ohio.*

▸ *DUCT HEATERS*—described in bulletin "GD-100" provide automatic heating for commercial and industrial applications in range of inputs from 50,000 to 230,000 Btu per hr. according to manufacturer. Includes specifications, dimensions, ratings and performance, and physical data. *L. J. Wing Mfg. Co., Dept. HPAC, 140 Freeland Mills Rd., Linden, N. J.*

▸ *ELECTRIC MOTORS*—New 12 page catalog describes, illustrates manufacturer's basic line of fractional hp electric motors, blowers, and special products. Dimension diagrams, standard ratings, other basic engineering information included. *Redmond Co., Inc., Dept. HPAC, Owosso, Mich.*

▸ *FLAME FAILURE*—safeguards are highlighted in bulletin "523" including safety factor of unit in eliminating explosions. Also, application to oil, coal, or gas installations described. *Photomation, Inc., Dept. HPAC, 96 S. Washington Ave., Bergenfield, N.J.*

Not 20 to 30 minutes—

but

Just 7 seconds to insulate this bend!

New Johns-Manville AEROTUBE insulation cuts labor costs 50%...and more!

New Aerotube® Insulation entirely eliminates twine wrapping, skirting and other time-consuming methods of insulating lines that sweat!

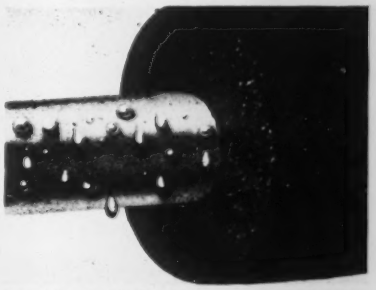
On a straight run of pipe or the most complex bend—Aerotube goes on fast! Just slides on new lines . . . six feet at a time . . . in a matter of seconds! On connected pipe, the job takes but little longer. Just the time it takes to slit Aerotube longitudinally, snap on pipe, and cement.

With all its savings in time, Aerotube gives you better results! Its unique closed-cell structure helps seal against heat transfer . . . gives Aerotube a built-in vapor barrier that retains its integrity indefinitely.

Use Aerotube wherever an effective vapor-sealed insulation is needed—air conditioning run-outs, CO_2 lines, dual temperature systems, on any line (to 200F) where Aerotube's labor savings will repay its slight additional cost many times over!

Send for informative new AEROTUBE brochure, IN-213A. It illustrates methods of fitting AEROTUBE to all types of fittings . . . sweat and screw type joints . . . and connected pipe. Gives best thicknesses for various design conditions, with helpful facts on sizes, packaging data and dimensions. *Write for your free copy now!* Address Johns-Manville, Box 14, N.Y. 16, N.Y. In Canada, Port Credit, Ont.

Flexible new foamed plastic insulation



Aerotube insulation is its own vapor barrier.

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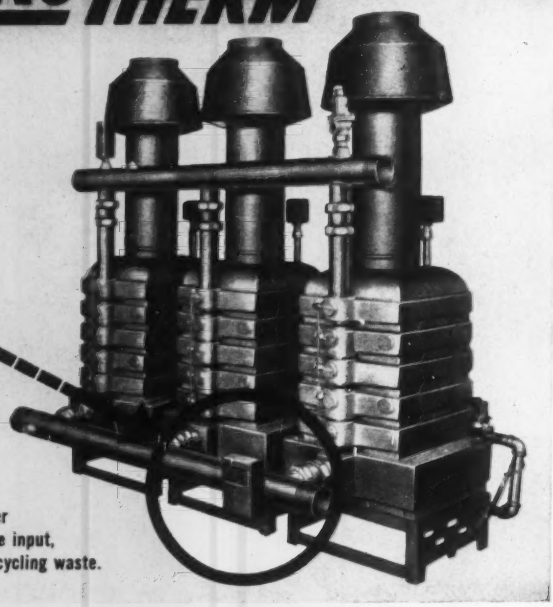
HYDROTHERM

PACKS A 20% GAS SAVING HERE

Here's where MultiTemp reduces gas costs by 20%. Return header has independent, differentially set aquastats that trigger each boiler, modulate input, and eliminate short cycling waste.

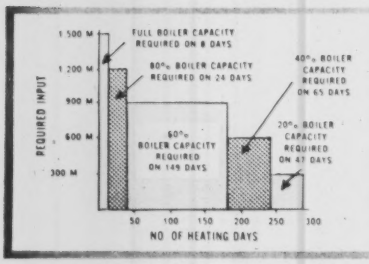


New MULTITEMP SYSTEMS

Make Gas Heat Competitive on "BIG JOBS"

Now even the big jobs requiring up to 3,600,000 BTU/hr input can enjoy the convenience and cleanliness of gas heat. A Hydrotherm MultiTemp system achieves true input modulation, brings gas consumption down and, being composed of multiple units, insures against service interruptions.

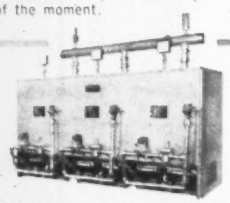
A MultiTemp battery of Hydrotherm boilers is hooked up with a separate aquastat for each boiler in the common return header. With each aquastat set for a different temperature, the boilers are fired or cut off independently. When the demand is small, only one boiler operates...when it is great or when the system is making a cold start, the complete heating plant is fired.



This graph shows the year-round load for a 1,500,000 BTU/hr hydronic plant in Bergen County, N. J., where degree days average 5600 to 6000. Heat was required for 293 days, but full capacity was needed for only 3% of that time.

Note how a single 1,500,000 BTU/hr boiler would have short cycled for 89% of the heating season at a great loss in efficiency. Note also how the MultiTemp battery of five 300,000 BTU/hr boilers modulated its input to meet the heating demand of the moment.

- ***Input Ratings from 360,000 to 3,600,000 BTU/hr***
- ***100 lbs. ASME Working Pressure***
- ***Boilers Shipped Pre-Wired and Assembled***
- ***Units Pass Thru 2'6" Doors***
- ***Ideal for Volume Hot Water***



Write today for MultiTemp Catalog

HYDROTHERM INC

DEPT. 13-AC NORTHVALE, NEW JERSEY

OTHER FAMOUS HYDROTHERM PRODUCTS: **HydroTherm • HydroVector • HydroChiller • HydroFin**

RECENT TRADE LITERATURE

Continued

▸ *FILMS ON PIPING*—in new catalog listing 23 new 16 mm films of technical and specialized industrial nature are available on loan. *Modern Talking Picture Service, Inc., Dept. HPAC, 3 E. 54th St., New York 22.*

▸ *FLOW TUBES*—designed for easy installation between pipe flanges are described in bulletin No. "115.20-1" containing dimension drawings and tables, chart of comparative pumping costs, graphs and listing of different construction combinations available. *B-I-F Industries, Inc., Dept. HPAC, 345 Harris Ave., Providence, R.I.*

▸ *FUEL OIL SLUDGE SOLVENT*—New 4 page bulletin "No. 594" discusses "Fuel-Solv," a fuel oil sludge solvent formulated to disperse, remove sludge present in tanks, suction lines, strainers, other parts of fuel oil systems. *Betz Laboratories, Inc., Dept. HPAC, Gillingham and Worth Sts., Philadelphia 24.*

▸ *GAS FLOW CONTROLS*—Company's gas flow controls equipment for argon, helium, carbon dioxide presented in new 12 page catalog. Operation, various applications described; photos of each equipment type shown. *Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC, 150 E. 42nd St., New York 17.*

▸ *HEAT EXCHANGERS*—Complete specifications on double pipe or hairpin heat exchangers given in new manual "M-100." Indexed manual broken down into seven major sections, covering scope, codes, guarantees, and drawings, as well as design, materials, welding procedure, testing. *Brown Fintube Co., Dept. HPAC, 510 Huron St., Elyria, Ohio.*

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...how much stronger...how much safer

Glasfloss* fiber glass Safety-Grille* filters really are

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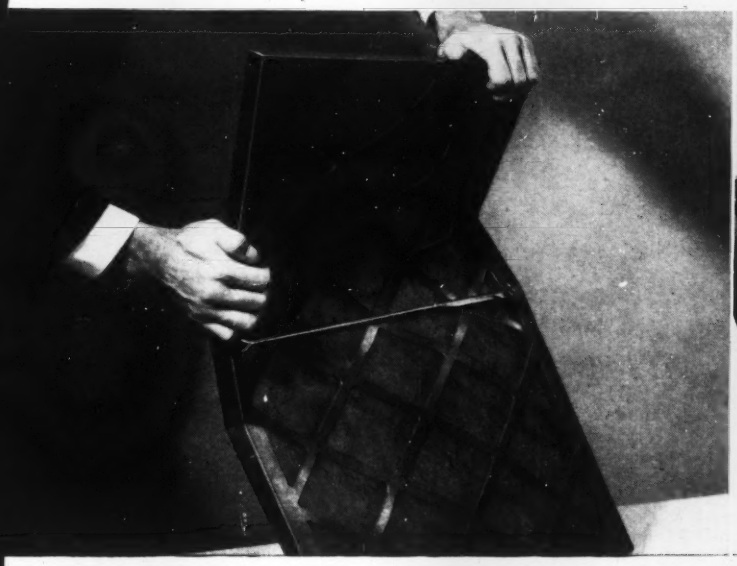

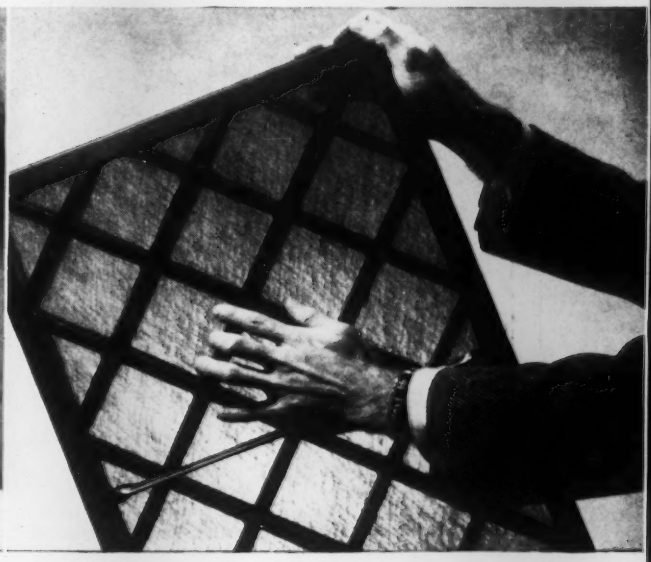

1. Bend it—and the new Glasfloss Safety-Grille Filter bounces right back to its original shape. Old type metal-grille filters don't. Unless you re-bend them, they stay bent out of shape and can cut down filtering efficiency. Strong construction of Glasfloss Safety-Grille Filters means less chance of damage in transit, in storage, in handling.

2. Feel the grille edge—it's chipboard, and perfectly safe! No sharp edges—no cuts, no scratches to worry about!

For maintenance personnel, the new Glasfloss Safety-Grille eliminates any danger of cut hands or wrists and possible infection when changing filters.

Plus these features... Glasfloss Safety-Grille Fiber Glass Filters . . .

—have same available filtering area and initial pressure drop as old-type filters
—are tested and proven in service
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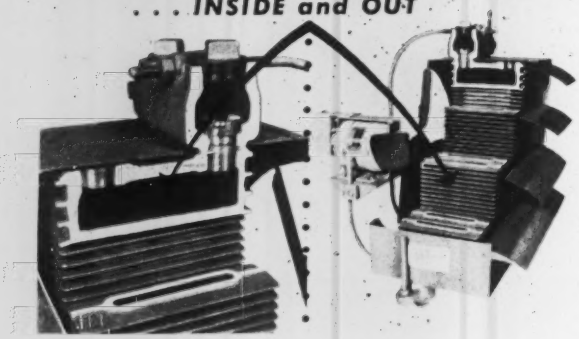
it's the material that makes the difference . . .

. . . INSIDE and OUT



CORROSION causes heating equipment failures!

BUT NOT WHEN YOU USE

GRID

cast iron construction

- UNIT HEATERS
- BLAST HEATERS
- RADIATORS

Designed for operation on steam pressure up to 250 PSI 450° temperature

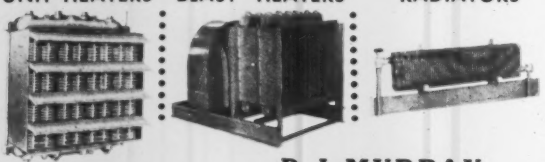
CORROSION internally, caused by electrolytic action as in copper tubes, can't happen in GRID's cast iron steam chambers and headers. Nor can acid condensate corrode the bottom connections. Cast Iron, internally, resists corrosion.

CORROSION externally, caused by acid fumes cannot destroy GRID's cast iron finned heating surface. Widely spaced fins cast integral with the steam chamber will not corrode externally.

ORDINARY HEATING SURFACES FAIL BECAUSE OF CORROSION INSIDE AND OUT! AVOID THESE COSTLY HEATING FAILURES!

Send for Catalog 956 . . . The complete story on Grid Unit Heaters, Blast Heaters and Radiators.

UNIT HEATERS BLAST HEATERS RADIATORS



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Manufacturers Since 1883

WAUSAU, WISCONSIN

OFFICES IN PRINCIPAL CITIES

RECENT TRADE LITERATURE

Continued

▸ *HEAT TRANSFER*—Bulletin gives information on heat transfer by radiation, conduction, convection. Problems involved in transmission of heat from hot gas through metal surface into water also covered. *Sellers Engineering Co., Dept. HPAC, 4876 N. Clark St., Chicago 40.*

▸ *HUMIDIFICATION*—Folder of 4 catalog sheets presents description, illustrations of installations of company's straight humidification in textile industry applications. *American Moistening Co., Dept. HPAC, Cleveland, N. C.*

▸ *HYDRAULIC TUBING*—characteristics are featured in new bulletin No. "1" along with specification data and chart giving chemical resistance to about 150 chemicals. *Synflex Products Div., Samuel Moore & Co., Dept. HPAC, Mantua, O.*

▸ *HI-I SYSTEM*—for multi-room buildings is described in catalog No. "EM59-2114" discussing three pipe induction system of air conditioning and heating which, according to the manufacturer, selects varying quantities of either warm or cold water and modulates flow to induction unit coils to maintain desired room temperature. *York Div., Borg-Warner Corp., Dept: HPAC, York, Pa.*

▸ *IMMERSION FIRING*—Bulletin "30-C" gives detailed report on immersion heating. Action of immersion firing in overcoming heat-flow resistance of dead gas film clinging to heating surfaces is covered in publication. *Sellers Engineering Co., Dept. HPAC, 1876 N. Clark St., Chicago 40.*

▸ *IMMERSION TUBE HEATING*—applications are discussed in bulletin No. "3". *Sellers Engineering Co., Dept. HPAC, 1876 N. Clark St., Chicago 40.*

▸ *INDICATING CONTROLLERS*—are presented and discussed in new illustrated four page bulletin. Specifications and dimensions for instruments which indicate any process variable convertible to an electrical quantity are also given. *Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N. J.*

1000 TON CAPACITY PLANT

...air conditions Des Moines newspaper building. 375,000 c.f.m. air circulation!

AIR CONDITIONING MILESTONE

DES MOINES—The combination 13- and 4-story Register-Tribune building is the only large newspaper publishing plant to be successfully air conditioned throughout from a single air handling unit.

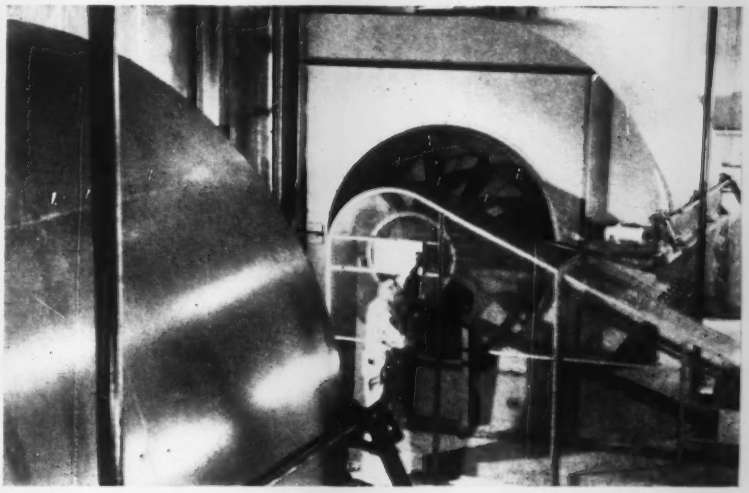
WIDE TEMPERATURE RANGE

In addition to fitting duct work into an almost impossible structural situation, the engineer was faced with widely varying room temperatures that result from the amazing variety of operations performed in a newspaper plant. Under one roof and in close proximity are hot stereoptyping operations, typesetting, darkroom facilities, wire service functions as well as office areas where humans work feverishly to satisfy the news demands of ever-humming, ever-hungry printing presses.

CHICAGO BLOWERS CIRCULATE 375,000 C.F.M. OF AIR THROUGH 1½ MILLION CUBIC FT. AREA

"One of the toughest problems," according to Mr. Wm. E. Nanes, consulting engineer, "was the cool air circulating fans."

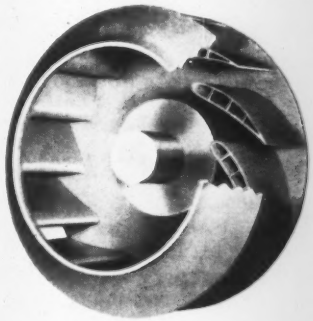
"The Register-Tribune people specifically requested the quietest fans available. It turned out that Chicago Blower Corporation could meet our needs on both counts. They had the capacity we wanted and their special hollow-sectioned air foil-blade construction made the fans surprisingly quiet."



Two huge Chicago Blower centrifugal airfoil fans handle 375,000 c.f.m. of air in supplying cool, conditioned air throughout the newspaper plant and office areas. Special "Chicago" aerodynamic fan blade design keeps noise level at an absolute minimum.

92% EFFICIENCY WITH LESS POWER

Two Chicago Blower fans, whose housings are 15' high, were used. Each fan rotor is over 7' in diameter and weighs 3000 pounds. Because the blades are aerodynamically designed, similar to an airplane wing, eddy currents responsible for turbulence and noise are virtually eliminated. Fan efficiencies are an amazing 92% and they operate on less power. Noise level over similar capacity units is reduced as much as 40%.



CHICAGO BLOWER ENGINEERING ASSISTANCE ALWAYS AVAILABLE

Chicago Blower plant and field engineers are always on call to assist firms working on heating and ventilating problems. They bring to any job a wealth of time-, trouble-, and money-saving information gained on thousands of installations.

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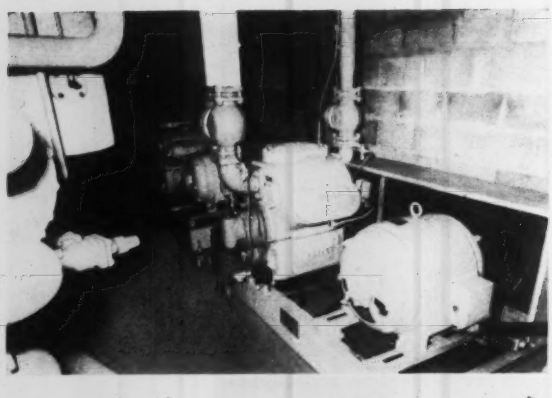
Your local Chicago Field Engineer is in the 'Yellow Pages'

Want all the facts about this aerodynamically-designed fan? Ask your "Chicago" field engineer for a copy of Bulletin A-103. You will find him listed under "Fans," "Blowers," or "Ventilating Equipment and Supplies" in the YELLOW PAGES of your phone book. If you prefer, write or call direct and complete information and service will be provided.



Beautiful Doctors Motel
St. Petersburg, Florida.

△

View of Vilter compressors that provide the refrigeration for the air conditioning system.

Comfortably Cool in a Warm Sunny Clime

Comfortably cool year 'round . . . inside, that is, at Doctors Motel, St. Petersburg, Florida. Dependable Vilter air conditioning is the answer.

There are 100 motel units at Doctors Motel and all are Vilter air conditioned. The system has a total capacity of 100 tons and is designed to keep the rooms at 78° F. and 50% relative humidity when outside temperature is 100° F. and humidity 90%.

This motel was opened to the public in December, 1956. From that time to the present *not a single adjustment has been required on the air conditioning system.* It is functioning perfectly and hasn't required any service work . . . a cost-saving installation. The owners are delighted with the performance of the Vilter system.

Vilter equipment installed at Doctors Motel includes two six-cylinder VMC Refrigerant-12 compressors; one shell and tube condenser, liquid receiver, water chiller and 100-ton heat exchanger.

Correct system layout, well-engineered equipment, careful fabrication, and floor testing of Vilter equipment pays off in efficient operation, long life and minimum maintenance. Why not call in Vilter for your refrigeration and air conditioning requirements.

Sold by Vilter Distributor, O'Dower Engineering Company, Kansas City 6, Mo.
Architects: Kivett, Myers & McCallum, Kansas City, Mo.
Mechanical Engineer: W. L. Cassell, Kansas City, Mo.

Write for this helpful bulletin to:
The Vilter Manufacturing Company, Dept. F-816
2217 S. First Street
Milwaukee 7, Wisconsin

Bulletin 820
Vilter VMC
Compressors

Vilter®
REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin
Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines

RECENT TRADE LITERATURE
Continued

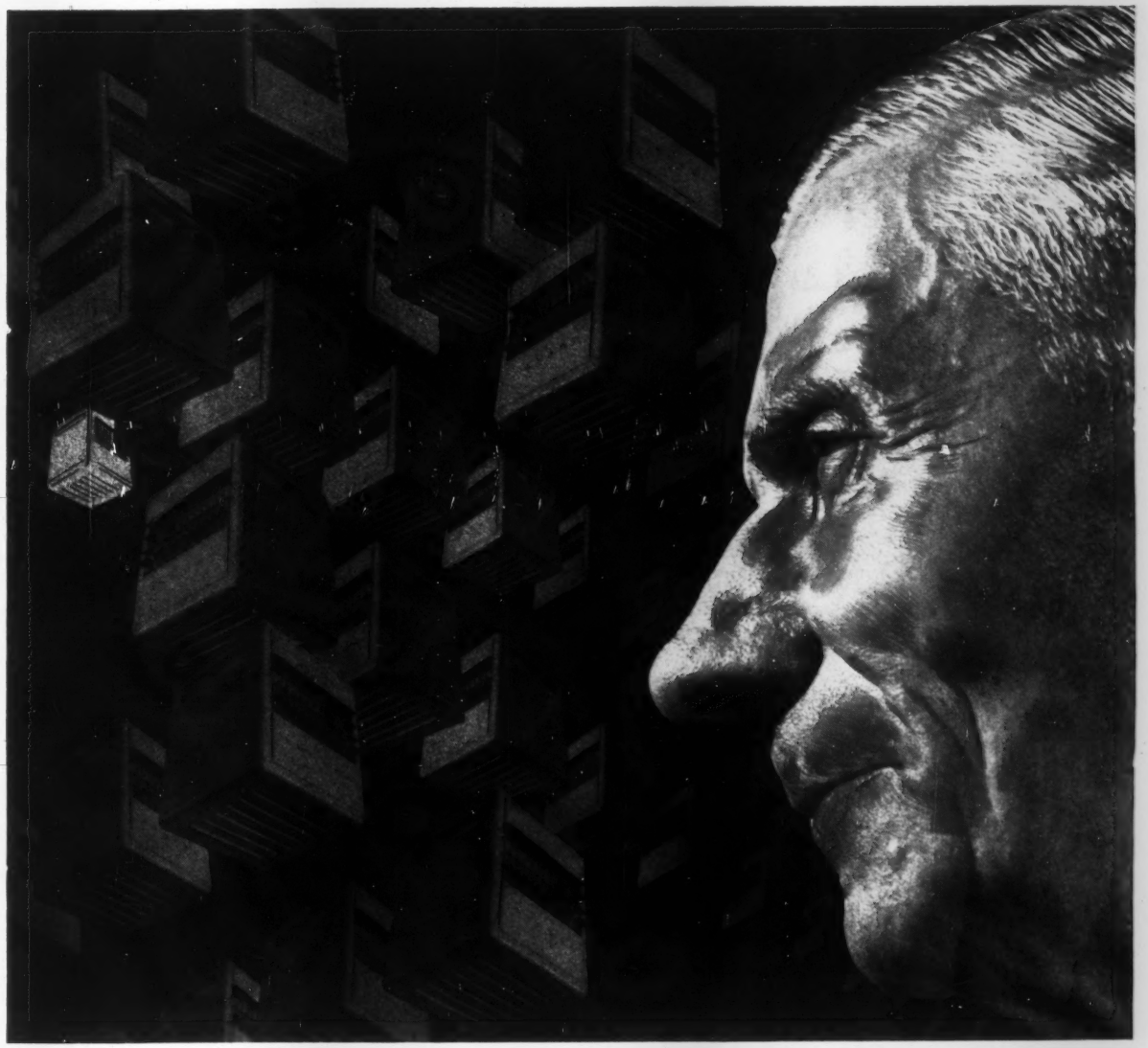
▸ *INDICATOR GAGES*—described in four new bulletins: "59-B211.12-13" covering application of gages employing diaphragm-type measuring element for low pressure, draft, or differential pressure measurement to 120 in. of water gage; "59-B214" is concerned with vertical scale indicator for pressure indication from 0.2 in. WG to 10,000 psig. *Hays Corp. Dept. HPAC, 800 E. Eighth St., Michigan City* 14, *Ind.*

▸ *INDUCTION MOTORS*—Folder of tables prepared to show how to select ratings for capacitors switched with induction motors. Publication "GED-3687" contains all performance data, specifications necessary for induction motor selection. *General Electric Co., Dept. HPAC, Hudson Falls, N. Y.*

▸ *INERT GAS WELDERS*—in new bulletin containing operating features, construction details and applications for new line of tungsten-inert-gas welding machines. *Lincoln Electric Co., Dept. HPAC,* 22801 *St. Clair, Cleveland* 17, *O.*

▸ *LIQUID LEVEL INDICATOR*—"Bulletin WG-1824, Supplement B" describes new miniature transistorized secondary liquid level indicator. Applications, operation, construction details, specifications all included in bulletin. *Yarnall-Waring Co., Dept. HPAC,* 107 *Mermaid Ave., Philadelphia* 18.

▸ *LUBRICANT SELECTOR*—"Bulletin 121" is "Molykote" lubricant selector chart designed to help in choice of lubricant for extreme pressure lubrication. Chart includes every type in line, gives evaluation on temperature, environment, method of application, incorporation into common materials; gives recommen-



TOUGH BUYERS demand Reznor unit heaters...

In 70 years, only 1/10 of 1% factory replacement!

If you want to avoid extra servicing and call-backs, you've *got* to be a tough buyer! You've got to pick a heater that not only works right when you buy it, but will keep on working right. That's why so many plumbing, heating and air-conditioning contractors demand Reznor. There may be less expensive heaters on the market, but none with Reznor's long-term performance record: only 1/10 of 1% factory replacement in 70 years!

EVERY UNIT FLAME-TESTED . . . You can be sure that your Reznor heaters will arrive in top running order. We flame-test each unit before shipment. Saves you the bother and expense of uncrating and bench-testing, too.

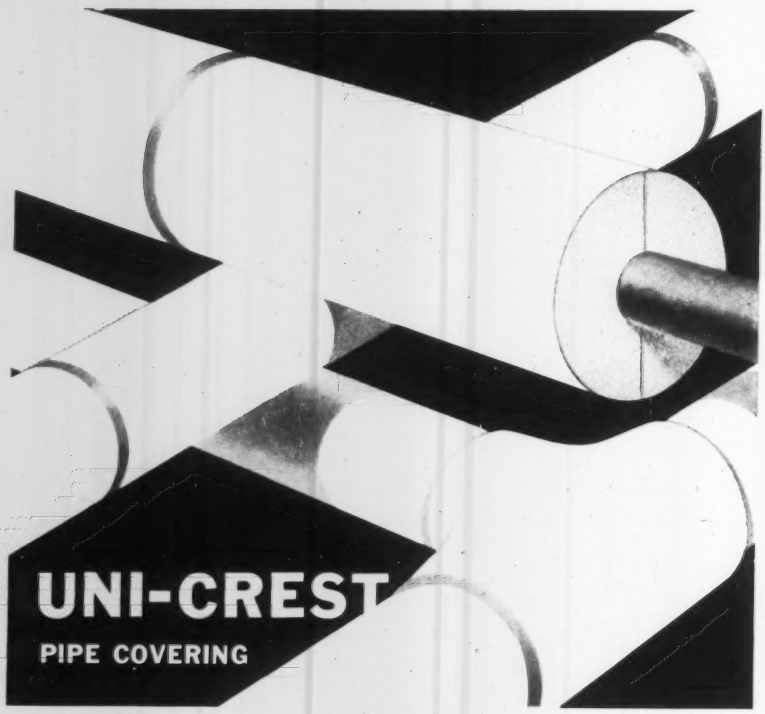
LONG-TERM FUEL SAVINGS . . . Here's where your customers benefit from your "tough buying." Reznor's sensitive, long-voltage thermostat and controls, and two-speed fan with automatic speed selector, keep heat even, without blasts. A Reznor uses less fuel to maintain comfortable heat.

For the full story, phone your Reznor distributor, or write Dept. 51A, Reznor Manufacturing Company, Mercer, Pennsylvania.

The heating world is full of tough buyers; that's why Reznor is the world's largest selling direct-fired heater!

REZNOR HEATERS

"THE TOUGH BUYERS' LINE"



a new, economical, low temperature insulation

Uni-Crest expanded polystyrene pipe covering is an excellent low temperature insulating material, and is inexpensive to install and maintain.

Its low thermal conductivity (K factor) plus its high resistance to water and water vapor — are some of its prime qualities. It will not rot, mildew, or support fungus growth.

Extremely lightweight, with a smooth, tough white surface, Uni-Crest is non-dusting, non-flaking, and easily cut and handled on the job.

Uni-Crest and self-extinguishing Uni-Crest are available in a wide variety of sizes and shapes. Both types are also available with or without a paper and foil laminate jacket.

For the address of the office nearest you, plus additional information and an actual sample, please write to the address below.

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RECENT TRADE LITERATURE
Continued

dations for specific lubrication applications, operations, conditions. *Alpha-Molykote Corp., Dept. HPAC, 65 Harvard Ave., Stamford, Conn.*

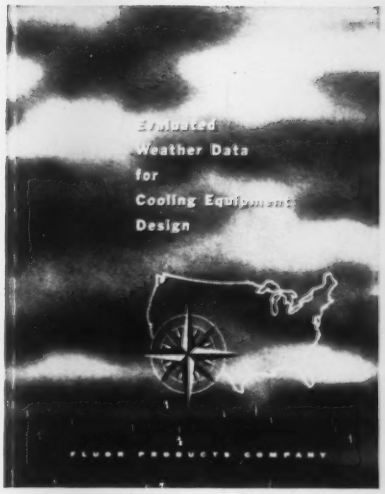
▸ *MASONRY ANCHOR*—that drills its own hole in concrete is described in new illustrated folder along with diagrams and tables indicating holding power up to 18,940 lb. *Rawlplug Co., Inc., Dept. HPAC, 238 Peters-ville Rd., New Rochelle, N. Y.*

▸ *MERCURY BULB ELEMENTS*—are discussed in new bulletin containing description of different types of elements and temperature ranges in addition to designations and markings, how to install mercury bulb elements, and chart on sample element specifications. *Partlow Corp., Dept. HPAC, 528 Campion Rd., New Hartford, N.Y.*

▸ *MOTORS IN THE MAKING*—is new 16mm sound color film showing manufacture of electric motors and describing testing of materials, tool and instruments used in manufacturing operations. Running time of film is 31 min. May be obtained on loan from: *L. C. Dobrunz, Wagner Electric Corp. Dept. HPAC, 6400 Plymouth Ave., St. Louis 33, Mo.*

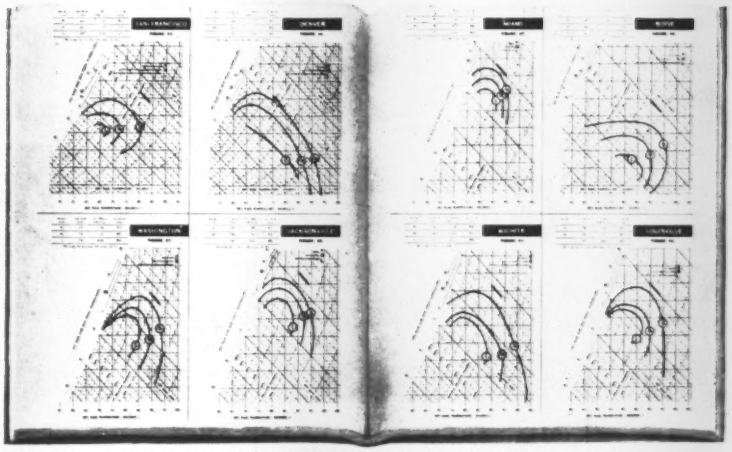
▸ *Mn WROUGHT IRON*—New 8 page booklet describes specialty alloy wrought iron containing approximately 1 percent manganese. Charts show metals impact resistance at temperatures below zero F. Working properties, availability, general suitability for low temperature services also discussed. *A. M. Byers Co., Dept. HPAC, Box 1076, Pittsburgh 30.*

▸ *MULTIPASS CONDENSERS*—of shell and tube type for refrigeration applications offering high resistance



At last a book that enables accurate specifying of cooling tower needs

EVALUATED WEATHER DATA FOR COOLING EQUIPMENT DESIGN



Typical pages. Over 400 locations are covered. 49 major industrial areas are presented graphically.

This is the most comprehensive and useful compilation of weather data ever published for the user of evaporative heat exchange equipment. It enables engineers in every part of the country to calculate cooling tower requirements correctly. It ends speculation in the sizing of equipment.

From years of cooling tower experience, the Fluor Products Company has realized that compiled weather data — *if truly adequate* — would solve a major problem shared by manufacturer, design engineer and user alike. To achieve this needed scope, Fluor utilized modern electronic data processing techniques to digest and tabulate five to fifteen years of hour-by-hour summer-season observations from over 400 weather stations—a total of 10,000,000 evaluated statistics.

EXAMINE THESE EXAMPLES OF THE BOOK'S VALUE

WET BULB TEMPERATURES

Hourly observations are tabulated for June, July, August and September, a total of 2,928 hours per year per location. Number of hours are tabulated during which wet bulb temperatures equal or exceed any particular value. Also shown are wet bulb temperatures equaled or exceeded by 1%, 5%, 15% and 50% of the total hours of the summer months. The first three frequency levels are also presented in iso-line map form.

COINCIDENT DRY AND WET BULB TEMPERATURES

Coincident presentation is given because the maximums in wet-bulb and dry-bulb temperatures do not occur concurrently in most locations. On psychrometric charts three lines are shown: an "H" line enclosing 99% of total summer hours, an "M" line enclosing 95%, and an "L" line enclosing 85%. The 5-degree dry-bulb range is denoted during which wet bulb extremes are most likely.

WIND DIRECTION AND VELOCITY

Wind coincident with high wet bulb temperature is shown in tabulated and graphic form. It is obvious that wind vitally affects the location and orientation of natural draft cooling towers—but it also affects mechanical draft towers since part of the moist, warm exhaust air may be caused to reenter the tower. Also, three frequencies of both wind direction and velocity are presented.

Other information presented includes influence of adjacent operations, terrain, vegetation, etc., and methods of interpolation between geographical locations and elevations.

A limited number of copies are available for qualified consultants, design engineers, and cooling-tower users. Please make requests on company letterhead and indicate title or position.

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Fluor PRODUCTS COMPANY

A DIVISION OF THE FLUOR CORPORATION, LTD.

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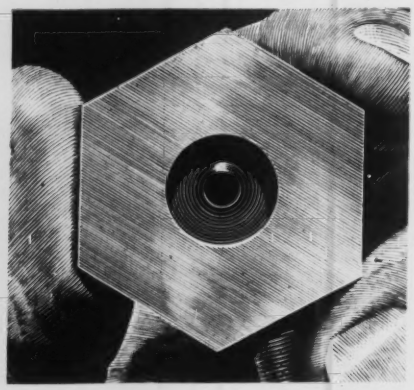


NEW Carrier "CANT-CLOG" SPRAY NOZZLE

Cuts maintenance costs on air washers, cooling towers and spray equipment

Proved in more than three years of service as standard equipment on Carrier air washers, this revolutionary new centrifugal type spray nozzle is now available as a replacement on all makes of spray equipment—as caps only or complete nozzles.

It's self-cleaning. It installs in seconds. It's low in cost. And since the orifice is formed in a flexible Buna-N rubber dome, erosion normally caused by restricting particles is eliminated. You get longer nozzle life, less down-time and better equipment performance.

For ratings and complete information on this money-saving new development, write Carrier Corporation, Syracuse, N.Y.

Carrier

RECENT TRADE LITERATURE *Continued*

to corrosion are detailed in bulletin No. "232-J" which illustrates construction features and lists dimensions. *Frick Co. Dept. HPAC, Waynesboro, Pa.*

▶ *NICKEL CASTING ALLOYS*—presented in new 27-page booklet which gives data on range of properties offered, industries served, and general applications for each alloy cited. *International Nickel Co., Dept. HPAC, Readers Service Section, 67 Wall St., New York 5.*

▶ *NOISE CONTROL*—is discussed in new 24 page illustrated booklet entitled "An Introduction to Noise Control." Included are noise control applications for air conditioning systems, and industrial applications. *Industrial Acoustics Co., Dept. HPAC, 341 Jackson Ave., New York 54.*

▶ *NOISE CONTROL*—*Booklet* "K4E" gives engineering specifications, performance data for 27 types of products for the control, measurement of machinery vibration, shock, noise. Installation photos show various applications. *Korfund Co., Inc., Dept. HPAC, 48-01 F 32nd Pl., Long Island City 1, N. Y.*

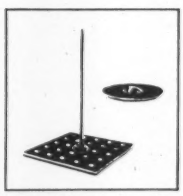
▶ *NON-RETURN VALVES*—"Bulletin No. S-2" presents details, specifications, operation and construction features of company's line of single acting non-return valves. Complete set of cross-sectional drawings and charts show operation of valves. *Golden Anderson Valve Specialty Co., Dept. HPAC, 207 Keenan Bldg., Pittsburgh 22.*

▶ *PACKAGED AIR CONDITIONERS*—are discussed in new catalog "No. 571" dealing with commercial and industrial comfort cooling installations requiring capacities from 3 to 15 tons. Included are complete di-

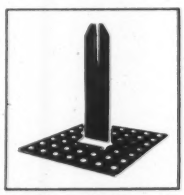
INSULATION INSTALLED FAST

WITH MIRACLE SURFACE ANCHORS

Use Miracle Surface Anchors, bonded with Miracle Anchor Adhesives, to provide firm support for block, board, or blanket type insulation. Eliminates drilling and welding. You save man hours, cut costs way down.



Use Spindle Anchors for bonding fibrous glass batts, mineral wool to ducts, walls, ceilings. Lock washer holds insulation firmly in place.



Use Pronged Anchors for bonding block insulation such as cellular glass. Pronged Anchors are set between rows of blocks and then prongs are bent over.

FREE

Valuable, informative engineers and architects bulletins giving details and complete specification data. Yours on request.

MIRACLE SURFACE ANCHORS
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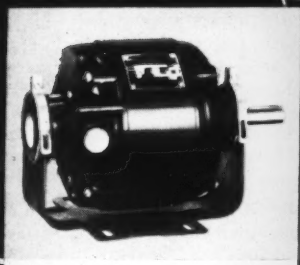

Put this special knowledge to work for you! Call, wire or write Dept. EE-2 today. The Emerson Electric Mfg. Co., St. Louis 21, Mo.

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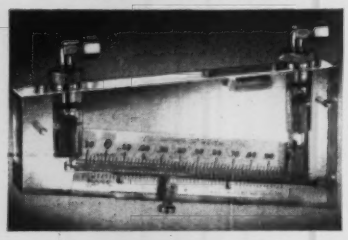
FILTER EFFICIENCY

at a glance...

ANYTIME!



Dwyer

AIR FILTER GAGE

With the Dwyer Air Filter Gage you can be sure of maximum filter efficiency because you know the *exact* time to replace filters, *every time*. Gives a continuous, accurate check that spots inefficient filters, yet prevents waste through premature replacement.

The Dwyer measures filter efficiency the only practical and economical way—via pressure drop. Quickly pays for itself through savings in replacement and service time and greater operating efficiency.

Break-proof plastic construction, lifelong accuracy, simple installation, no moving parts to ever wear out or get out of adjustment. Ranges 0-½", 0-1", 0-2" and 0-3" water. A complete unit with all necessary tubing, fittings, etc.

Write for Bulletin C10

F. W. DWYER MFG. CO.

P. O. Box 373-H • MICHIGAN CITY, IND.

RECENT TRADE LITERATURE

Continued

mensions and specifications, detailed construction drawings, and other engineering information. *Acme Industries, Inc., Dept. HPAC, 600 N. Mechanic St., Jackson, Mich.*

▸ *PACKAGED AIR CONDITIONERS*—their design and construction features as well as capacities and physical data are presented in brochure "8525". *American-Standard Industrial Div., Dept. HPAC, Detroit 32, Mich.*

▸ *PACKAGED BOILERS*—through 600 hp are discussed in new brochure which covers standards, trends, design, operation, efficiency ratings. *Cleaver-Brooks Co., Dept. HPAC, 326 E. Keefe Ave., Milwaukee 12.*

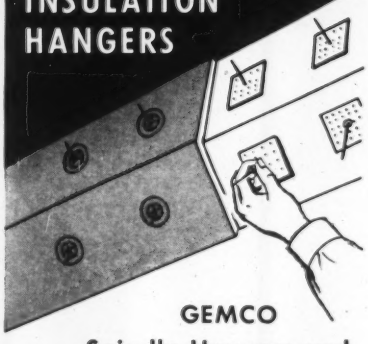
▸ *PACKAGED LIQUID CHILLERS*—"Bulletin No. 802-A" presents manufacturer's line of packaged liquid chillers. Specifications, features, construction and operation details given in bulletin. *Frick Co., Dept. HPAC, Waynesboro, Pa.*

▸ *PIPE INSULATION*—for three underground piping systems incorporating encased insulating concrete conduit is described in four page brochure along with data on qualities and specifications. *Concrete Thermal Casings, Inc., Dept. HPAC, 2107 N. 34th St., Seattle 3, Wash.*

▸ *PIPE MARKERS*—for standardized pipe identification system consisting of colored tape which stands temperatures up to 300 F are described in bulletin No. "135-E" which illustrates markers, lists specifications, and gives various uses. *W. H. Brady Co., Dept. HPAC, 727 W. Glendale Ave., Milwaukee 9.*

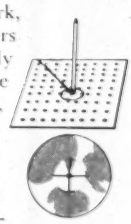
▸ *PIPE TAPE*—having high dielectric strength featuring high degree of

SAVE TIME—
SAVE MONEY
with these dependable
INSULATION
HANGERS

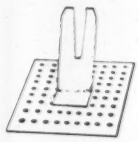


GEMCO
Spindle Hangers and
W-A Self-Locking Washers

Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed... with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.



GEMCO Pronged Hangers



Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1 3/16" to 6 7/8") bend over to hold insulation firmly in place.

TUFF-WELD Nylon Hangers

Two-piece hangers... with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and Improved General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

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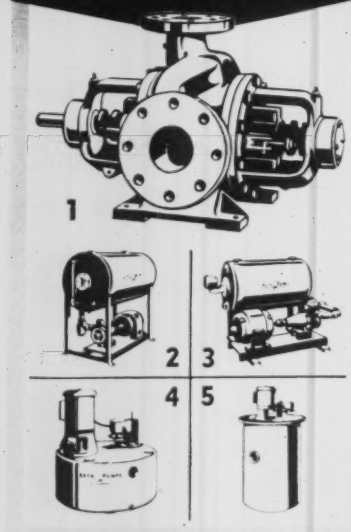

1 — Two Stage Turbine Pumps
2 — Boiler Feed Units
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To the engineer, the name ROTH means a full selection of one and two stage, high and low pressure condensate pumps; packaged boiler feed units; and packaged condensate return units — all designed to meet the most exacting specifications and built to give maximum life and performance . . . Complete, easy-to-choose selection data saves time and error in writing specifications.

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Jobbers — be ready to answer your local contractors' questions on ROTH equipment and prices. Find out about ROTH sales policy and factory assistance. Catalog gives complete, easy-to-find selection and price data on ROTH power plant pumps and equipment. (Extra copies available for jobber distribution.) Your registered copy will be kept up-to-date by an automatic catalog mailing system. Copies also available to contractors and engineers.

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RECENT TRADE LITERATURE
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resistance to water, oils, alkalis, acids, and common solvents is described in new six page booklet which includes chart of pipe wrap coverage data and specifications for use of tapes. *Permacel, Dept. HPAC, New Brunswick, N.J.*

▸ *PIPE REPAIRS, TAPPING*—covered in new 44 page book containing installation photos, line drawings, and descriptions. *Smith-Blair, Inc., Dept. HPAC, 535 Railroad Ave., South San Francisco, Calif.*

▸ *PIPE WEIGHTS*—Dimensions, weights per ft of pipe in sizes $\frac{1}{8}$ through 36 in. for all schedules given on card newly available from company. Data card designated "TDC-191." *Babcock & Wilcox Co. Tubular Products Div., Dept. HPAC, 712 Eleventh St., Beaver Falls, Pa.*

▸ *PIPELINE FILTER*—is described in detail in bulletin "A-1081" which includes dimensions for 66 filters with capacities up to 43 gpm for service up to 5000 psi at −65 F to 275 F. *Aircraft Porous Media, Inc., Dept. HPAC, 30 Sea Cliff Ave., Glen Cove, N.Y.*

▸ *PLASTIC INSULATION*—Sound and color strip film, entitled, "Insulating With Plastic," traces recent development of flexible, foamed plastic insulation; describes its properties, shows number of application techniques in installations throughout the country. *Armstrong Cork Co., Dept. HPAC, West Liberty St., Lancaster, Pa.*

▸ *PRINT FILE*—1959 catalog of manufacturer's line of vertical and roll filing systems for drawings, blueprints recently made available. New,

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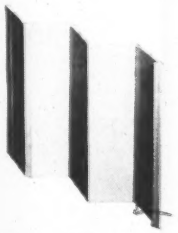
PLASTIC
MOISTURE ELIMINATOR BLADES
for
Industrial Air-Conditioning
are
MORE ECONOMICAL

SOPLASCO Plastic Moisture Eliminator Blades are the finest at the greatest economy! The outstanding physical and chemical properties of SOPLASCO Blades make these blades more efficient and require a minimum of maintenance. Because of these and many other factors, you'll reduce your costs considerably when you specify SOPLASCO Plastic Moisture Eliminator Blades.



For further information write, wire, or phone SOPLASCO AIR PRODUCTS DEPT.

Southern Plastics Co.

408 Pendleton St.
Columbia, S. C.

Expansion Joint Design Moves out of the "Model T" Era

Badger first began fabricating packless metal bellows expansion joints more than 35 years ago. These "Model T" joints performed (and are still performing) with outstanding success in hundreds of process and steam line piping installations.

Starting in the 30's other expansion joint manufacturers entered the field. The most successful adopted many of the basic features of the original Badger design.

During the last decade, as industry's requirements became more stringent, and joint manufacturers gained fabricating and field experience, certain fundamental problems inherent in the early designs became evident. Most of these problems were solved through a series of modifications. (Among which was the Badger Directed Flexing Self-Equalizing Joint — the famous "DFSE" Design.) But, at best, the modifications were stop-gap measures which complicated the joints and greatly increased their weight. A fundamental reassessment of expansion joint engineering data was needed. Badger led the way: In 1956, a task force completed a three-year research program and the first S-R (Service-Rated) Expansion Joints were produced.

In the three years they have been available, S-R Expansion Joints have been both an engineering and a sales success. But like many revolutionary concepts which upset tradition, the full implication of the advantages S-R Joints offer is still not universally understood. The message that follows is an attempt "to set the record straight."

• • • • •

Equalization — fact and fiction

Many users of expansion joints are under the impression that the so-called "equalizing" rings on today's conventional type expansion joints distribute movement equally among all the corrugations of the bellows. It is argued that as the joint absorbs thermal movement, the tops of the rings progressively come into contact until the bellows is fully compressed thus limiting the amount of compression which any one corrugation can ultimately absorb (see diagram 1). In *this* sense the rings do contribute to the "equalization" of movement by physically limiting the compression of each corrugation to the distance between any two adjacent rings.

Diagram 1

Conventional Type Expansion Joint. Cross-sections of rings and bellows of a conventional "self-equalizing" joint showing cold and hot positions. Note that true equalization of movement can only be obtained when tops of all rings are in contact — an impractical and dangerous situation.

Note, however, that the degree of compression will not be truly equalized until the tops of all the rings are in contact. But, when such a condition occurs, serious problems will result. If the limit of compressibility is reached before the thermal expansion has been completely absorbed, exceedingly large forces will be transmitted through the pipe line to the anchors and connected equipment. On the other hand, if the joint is compressed only partially, not all of the corrugations will absorb movement to the same degree.

How S-R Joints solve equalization problem

Badger S-R Expansion Joints feature the new Curvilinear Corrugations which naturally assume an "all curve" shape under pressure (diagram 2), assuring more equal distribution of stresses throughout the bellows material. Furthermore, the shape, height and pitch of the corrugations are based on a carefully engineered correlation. Thus, reasonably equal distribution of movement among the corrugations is obtained, even in joints not equipped with reinforcing rings.

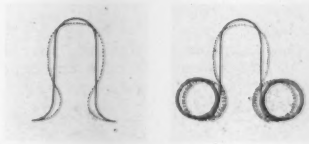


Diagram 2

Badger S-R Expansion Joint. Cross-sections of S-R Joints (Series 50 left, Series 150 right). The movement of the corrugations is shown by dotted and solid lines. Compare configuration and effective height of corrugations, position and size of rings with conventional joint.

Equalization of movement is inherent in the design and functioning of the bellows on Badger S-R Joints. On the basis of provable engineering criteria, the prime purpose of reinforcing rings of any design is to retain the hoop dimension (diameter) of the corrugations when they are subject to internal pressure. This Badger's simple, lightweight tubular reinforcing rings do. But, in addition, the new tubular shape of the rings does contribute to joint flexibility and life by permitting flexing over a more effective portion of the total corrugation height than conventional cast or fabricated equalizing rings.

Better performance, lower cost

Briefly, then, Badger S-R Joints alone offer these advantages: Better equalization of movement which results in elimination of localized stresses and leads to longer joint life; a simple, lightweight design that makes installation easier, eliminates cumbersome castings and fragile mechanical devices; complete range of sizes from 3" to 72" made from any workable metal and with a wide choice of accessories.

Badger S-R Joints are probably the answer to your problem. There's an easy and quick way to find out — ask the Badgerman for his recommendations. Write or phone today. Badger Manufacturing Co., 230 Bent St., Cambridge, Mass.

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BADGER S·R EXPANSION JOINTS

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28-42 OGDEN ST. NEWARK 4, N.J.
WORKING PRESS:- SHELL TUBES
UNIT NO. JOB NO.

FUEL OIL
HEATERS
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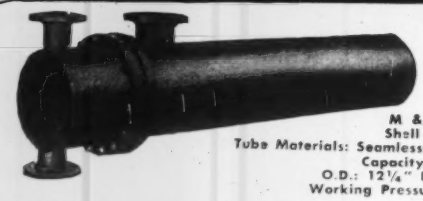

M & L CONVERTER
Shell Material: Steel
Tube Materials: Seamless Drawn Copper
Capacity: 13,200 g.p.h.
O.D.: 12¼" Length: 106½"
Working Pressures: 150 P.S.I.

The above unit is one of several M & L Converters now installed at Idlewild Airport in New York. They were designed and fabricated to furnish the heating system of a hangar with water at 140°F.

In order to meet exact specifications, minor changes were made in standard M & L Converters and one more successful installation went into the record.

Our long proven ability to design for a specific need has been extremely helpful in thousands of successful installations all over the country. This service is as near to you as your telephone.

For further details send for your copy of bulletin 780, or we will be happy to send a representative to assist you with any heating or cooling problem.

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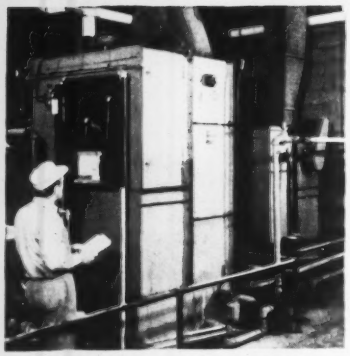
- to control your product quality
- to protect a critical operation
- to protect apparatus from moisture damage
- to DRY your material or product
- to control packing or storage conditions
- to assure precision in testing or research
- to increase air conditioning capacity

Air Condition by the NIAGARA Method Using HYGROL Liquid Absorbent



This compact method, giving high capacity in small space, removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the air.

Most effective because... it removes moisture as a separate function from cooling or heating and so gives a precise result, and always. Niagara machines using liquid contact means of drying air have given over 20 years of service. The apparatus is simple, parts are accessible, controls are trustworthy.

Most reliable because... the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions... no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

Most flexible because... you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Write for Bulletins 112 and 131 and complete information on your air conditioning problem.

NIAGARA BLOWER COMPANY
Dept. HP-9, 405 Lexington Ave., New York 17, N.Y.
Niagara District Engineers in Principal Cities of U. S. and Canada

RECENT TRADE LITERATURE

Continued

improved items included in bulletin, with illustrations of all products also included. *Plan Hold Corp., Dept. HPAC, 5204 Chakemco St., South Gate, Calif.*

▸ *PUMP CUPS*—for pump pistons, hydraulic service, and pneumatic equipment are described in new bulletin "AD-145" as well as tables illustrating cups for recommended services. *Garlock Packing Co., Dept. HPAC, 136 Main St., Palmyra, N.Y.*

▸ *PURIFIERS, SCRUBBERS*—are cataloged in bulletin "803" describing specification, operation, guarantees, code information, typical installation drawings, and engineering data. *V. D. Anderson Co., Dept. HPAC, 1935 W. 96th St., Cleveland 2, O.*

▸ *PROPELLER FAN*—New 20 page catalog gives details on manufacturer's complete line of self-cooled motor propeller fans. Motor specifications, fan construction and dimensions on fan line ranging in capacities from 250 to 40,500 cfm included in publication. *Ilg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago 41.*

▸ *REFRIGERANT FILTER*—Cleaning and filtering of refrigerant systems is covered in "Folder A-12". Bulletin contains information on cleaning refrigeration systems; on importance of low side filtration; dimensions, ratings of manufacturer's complete line of "Permaclean" filters. *McIntire Co., Dept. HPAC, P. O. Box 5, Livingston, N. J.*

▸ *ROLLER BEARINGS*—of nine principal lines are featured in new illustrated catalog "PL-559" which includes general features, size, and application data. *Rollway Bearing Co., Dept. HPAC, Syracuse 4, N.Y.*

VIBRATION & NOISE CONTROL NEWS

FROM THE APPLICATION ENGINEERING DEPARTMENT OF THE KORFUND COMPANY, INC.

Spring Isolators Permit Roof Mounting of 530 Ton Refrigeration Machine... Increase Rentable Space in D. C. Office Building

Department Store Gets Noise-Free Sales Area By Spring Mounting Penthouse Fan

In planning the Lit Bros. Department Store, Camden, N. J., Thalheimer & Weitz, Philadelphia architects and engineers, wanted to be sure that vibration and noise from penthouse fans would not disturb patrons in the sales areas below. Also, the fan's mounting system had to provide maximum protection of the building structure.

Together with the Carrier Corp., suppliers of the air conditioning equipment, they decided on Korfund steel spring mountings to handle the important job of vibration and noise control.

Working closely with the architects and the air conditioning contractor, Korfund engineers mounted the fan together with its structural steel base on special Korfund Type UP isolators, in order to provide all the static deflection needed to stop the transmission of low frequency disturbance. The isolators themselves were cemented to Elasto-Rib sound insulation pads, eliminating all anchor bolts. The result is air-conditioned — and noise-free — comfort for Lit Brother's patrons, even in the area directly below the fan.

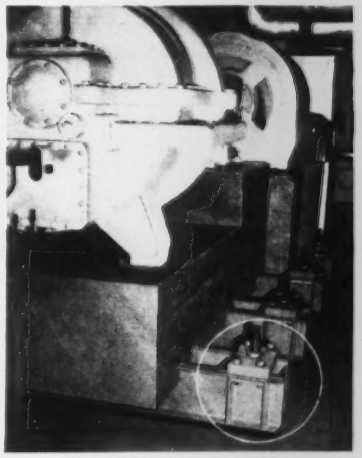
Westinghouse #155 SV-10 fan and its 200 hp, 1500 pound motor at the Lit Bros. Department store, Camden, N. J. Korfund spring mounts permitted installation of this fan and a smaller one in machinery penthouse directly over a sales area, prevented vibration transmission.

Korfund steel spring isolators were called upon to perform a critical job of vibration and noise control in the Cafritz Building, Washington, D. C.* The "drive-in" office building features basement parking, requires roof top mounting of all equipment in order to get maximum rental space in the parking area. Yet noise or vibration transmission from the equipment to the offices below could not be tolerated.

Potential source of trouble was the 530 ton centrifugal refrigeration machine, key unit in the building's air conditioning system. It was apparent that extreme isolation efficiency was needed to prevent annoying vibration from penetrating the upper stories and also to protect the building structure.

When Korfund engineers were called in they recommended soft, resilient mounting, similar to that used successfully by Korfund in hundreds of thousands of other tough installations of all types. Following their recommendation, 8 performance-guaranteed Type U V Steel Spring Vibro-Isolators were used to float the machine, completely eliminating vibration and noise transmission at a cost of only $1500.

The effective isolating characteristics engineered into Korfund vibration and noise control units give them wide application for all roof-top and other critical installations.



Circled is one of the 8 Korfund Vibro-Isolators used to "float" office building refrigeration machine.
*Architect: LeRoy L. Weiner
Consulting Engineer: William Brown
Builder: Cafritz Construction Co.
Mechanical Contractors: Mehring & Hanson Co.

Noise Free Heating-Cooling System 8 Stories Up

Photograph shows a boiler, part of the complete Korfund-mounted heating and air conditioning system, being installed on the roof of the 8-story 1500 Massachusetts Ave.* apartments, Wash., D. C.

The installation, which includes boilers, pumps, compressors and fans, has been in operation over 6 years. Vibration and noise isolation is so complete that tenants on the floor below are unaware of the existence of the equipment immediately over their suites. Cost? Only about $5,000 on a mechanical equipment contract of approximately $1,000,000!

The efficiency of Korfund units for isolating noise and vibration did not come about by accident. It's the result of more than half-century of experience in vibration and noise control. To learn how this experience can work for you just drop a line to Korfund or call the Korfund representative in your area.

*Architect: F. Wallace Dixon
Consulting Engineers: Karsunky, Weller & Gooch
Builder: Ring Engineering Co.

FOR MORE DATA OR SPECIFIC RECOMMENDATIONS WRITE TO KORFUND FOR BULLETIN #66

KORFUND

THE KORFUND COMPANY INC.
48-01F 32nd Place • Long Island City 1, New York

VIBRATION • SHOCK • NOISE / CONTROL AND MEASUREMENT
Specialists for over half a century

ENGINEERED FOR INDUSTRY

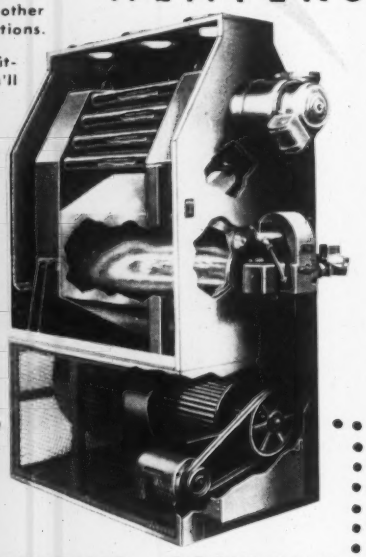
arkos

DIRECT FIRED HEATERS

Designed by experienced combustion engineers, ARKOS Heaters provide superlative service for factories, warehouses, plants, churches, and other types of industrial and commercial installations.

ARKOS Heaters guarantee a reliable and profitable installation. We'll tell you why if you'll write us today!

- Integrated Control Panel
- Internal Radiation Shields
- Floating Combustion Chamber
- Life-time Sealed Main Blower Bearings
- 14 Gauge Stainless Steel Combustion Chamber
- Hexagonal Shape Combustion Chamber
- All Burners Power Rated Type



WRITE FOR LITERATURE

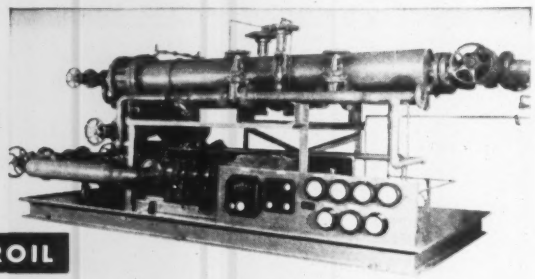
arkos MANUFACTURING COMPANY

7310 woodward avenue detroit 2, michigan

Fuel Oil Pumping & Heating Units

FOR EVERY REQUIREMENT

NATIONAL AIROIL

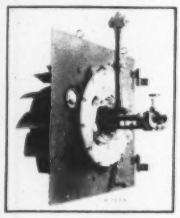


We make a full line of Fuel Oil Pumping and Heating Units to prepare heavy fuel oil for combustion with all types of Oil Burners. Illustrated is a compact, space saving Unit of 50 g.p.m. burning rate — twin motor driven pumps and twin oil heaters built to A.S.M.E. Code. Control panel includes: Pilot Control Thermometer, Pressure Pilot Control, Gauges to indicate oil inlet to each heater, Temperature and Pressure Suction Vacuum, Oil outlet pressure from each Heater and main Steam Pressure to each Unit . . . Temperature and Pressure Control Valves are air actuated for quick response, and to hold discharge pressure and temperature within 1%, from minimum to maximum firing rate.

Send for Catalog No. 40 which gives standard sizes and capacities; special units built to order.

UNIVERSAL REGISTER UNITS

We make various types of Universal Register Units including the swing-type, as illustrated. The Unit illustrated can be furnished with Gas Burners, ring or cylinder type, and/or Oil Burners, for either natural or forced draft . . . All vanes are variable independently of each other, and reversible from left to right turbulence (or vise versa) as a Unit. Integral damper disc permits closing-off each individual burner tile to prevent air leakage on shut-down.



National Airoil

BURNER COMPANY, INC.

Main Office & Factory 1356 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.

SOUTHWESTERN DIVISION 2512 SOUTH BOULEVARD, HOUSTON 6, TEXAS

INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

RECENT TRADE LITERATURE

Continued

▸ *ROTARY BURNERS*—designed for heated residual No. 6 fuel oil of viscosity between 45 and 300 S.S.F. at 122 F and with firing rates of 15 to 175 gph featured in bulletin No. "415" which includes capacities and specifications. *Preferred Utilities Mfg. Corp., Dept. HPAC, 41 E. 42nd St., New York 17.*

▸ *SAFETY RELIEF VALVES*—"Catalog 88" gives detailed information on company's full line of safety relief valves for power, processing, and general industrial services. Included in publication are engineering charts, data, valve discharge capacity tables for liquids, air and gas, and steam. *Marine & Industrial Products Co., Dept. HPAC, North Wales, Pa.*

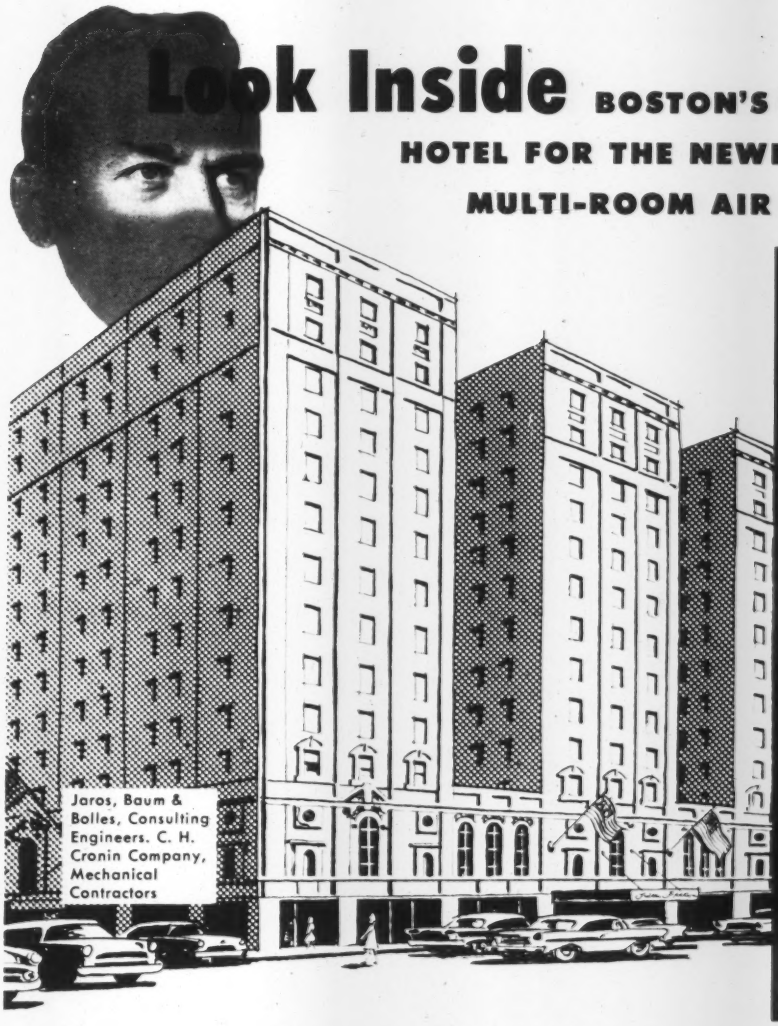
▸ *SELECTOR CONTROL*—with adjustments for remote manual trimming of pneumatic control systems, and for transferring from automatic to manual operation are shown in specification "P99-1" which describes 32 standard types classified according to application. *Bailey Meter Co., Dept. HPAC, 1050 Ivanhoe Rd., Cleveland 10.*

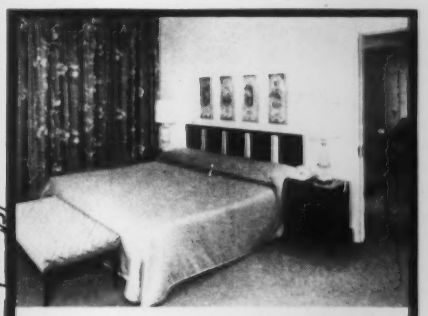
▸ *SHEET METAL SPECIALTIES*—information serving variety of applications is available in new 12 page brochure "35-8" discussing round metal ducts for high velocity, high pressure air conditioning systems, as well as irrigation, grain handling, mine ventilation, exhaust lines. *Carrier Corp., Dept. HPAC, Syracuse 1, N.Y.*

▸ *SIGNALING CONTROLLER*—is used for accurate and automatic control of many industrial processes such as for pickling tanks, and other similar applications as described in new catalog. *Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N.J.*

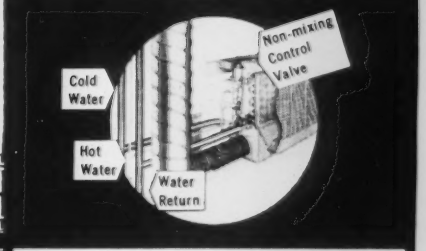
Look Inside BOSTON'S *Statler Hilton*

HOTEL FOR THE NEWEST IDEA IN MULTI-ROOM AIR CONDITIONING . . .





York 3-pipe system responds instantly to changes in temperature setting—allows wide variation from room-to-room—satisfies each guest's exact wishes.



Non-mixing 3-way valve selects hot or cold water and modulates flow to coils. Air drawn across coils is warmed or cooled. Water shuts off if neither is needed.

Exclusive YORK 3-PIPE Hi-I INDUCTION SYSTEM economically provides personalized comfort for 1300 rooms!

Instant Temperature Response Both hot and cold water are ready and waiting at each unit. When thermostat setting is changed, either one or the other immediately flows to the coils to provide desired temperature. No delays, no wasteful mixing of hot and cold water, no changeover.

Heats and Cools Economically With Existing Steam Existing high pressure steam is used twice in a two-step water chilling operation to produce 812 tons of cooling with utmost economy. The same steam used by a 574 ton York absorption system supplies 238 tons of additional capacity in a steam turbine driven York centrifugal system *with no increase in operating cost!* For maximum flexibility and simplicity, the chilled water system is arranged for series flow, first through the absorption system and then the centrifugal system.

Reduces Initial Cost High-efficiency York induction units permit reducing primary air supply to desired ventilation requirements. This saves money and space by reducing duct and fan sizes, eliminating return air systems. No duplicate zoning equipment is required, either.

Saves on Operating Costs The constant availability of both hot and cold water at each unit provides controlability while eliminating the wasteful practice of counteracting excess heating with cooling as is standard with other systems.

For complete product data, write Engineered Machinery Division, York Corporation

YORK

YORK CORP. SUBSIDIARY OF BORG-WARNER CORP.®
2009 SOUTH GRANTLEY ROAD, YORK, PA.

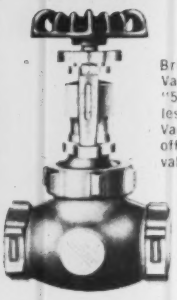
BORG-WARNER
RESEARCH & ENGINEERING
MAKE IT BETTER

Air Conditioning, Heating, Refrigeration and Ice-Making Equipment • Products for Home, Commercial and Industrial Installations

Heating and Air Conditioning

FLOW CONTROL

HANCOCK VALVES DO THE JOB *ECONOMICALLY*



Bronze "Flocontrol" Valves. ¼" thru 2". "500 Brinnell" stainless steel V-port disc. Variable orifice, shut-off and index in one valve.

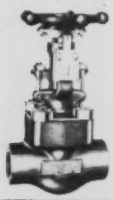
Reliable control of flow contributes substantially to complete owner satisfaction with every heating, piping, and air conditioning system you install.

Whether the application demands pin-point control of flow or full flow, Hancock Valve performance proves there is no substitute for the economy of quality. Highest operational perfection is combined with lowest maintenance. Whatever the piped medium – fuel oil, gas, water, or steam – the quality of Hancock Valves helps assure uninterrupted service. Typical advantages of Hancock Bronze and Steel Valves are:

RUGGEDNESS that continues to ward off the deteriorating effects of wire drawing, galling, steam cutting, erosion and corrosion long after ordinary valves fail.

MAINTENANCE ECONOMY because carefully selected materials are precision-formed into functional parts of long-lasting efficiency. Servicing can be done in the line. Standardization of components means inventory economy.

Learn all the job-proved reasons why Hancock Valves are today's best buy in terms of your standard of reliability. Globe, Angle, Gate, and "Flocontrol" types available with application characteristics suited to your heating, piping, and air conditioning requirements. *Write for Catalog 200A.*



Steel "Flocontrol" Valves. ¼" thru 2". V-port disc compels proportional flow throughout the lift of the stem.

600# Steel Gate Valves. ¼" thru 2". Forged steel body. Maximum use of stainless steel.

600# Steel Valves. Globe and Angle. ¼" thru 2". Forged steel body. "500 Brinnell" stainless steel disc.

Bronze Valves. Globe and Angle. ¼" thru 2". "500 Brinnell" stainless steel seat and disc. 125% to 230% stronger diaphragm.

MAXWELL MANNING MOORE INC. MM&M TRADE MARK

HANCOCK VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

RECENT TRADE LITERATURE

Continued

▸ *SMALL VALVES*—Brochure "KS-1-N" gives details on company's line of small valves for general applications. Publication includes information on working pressures, specifications, construction features, suggested applications. *Kerotest Mfg. Co., Dept. HPAC, 2525 Liberty Ave., Pittsburgh 22.*

▸ *SMOKE ALARM-CONTROLS*—"Bulletin 553" gives information on "Electric Eye" unit designed to guard against smoke circulated by air conditioning system. *Photomation, Inc., Dept. HPAC, 96 S. Washington Ave., Bergenfield, N. J.*

▸ *SMOKE DETECTING EQUIPMENT*—for ventilating systems where presence of smoke might result in panic and to comply with New York City Local Laws 31, 33, 34, described in new brochure including illustration of mechanical operation, maintenance. *Walter Kidde & Co., Dept. HPAC, 675 Main St., Belleville 9, N.J.*

▸ *STAINLESS PIPE*—welding characteristics are contained in folder "TDC 162" which includes table indicating electrodes, preheating and post welding heat treatments to be used in joining stainless steel to each other and to dissimilar metals. *Babcock & Wilcox Co., Dept. HPAC, 712 Eleventh St., Beaver Falls, Pa.*

▸ *STAINLESS STEEL VALVES*—"Bulletin No. 11" presents manufacturer's line of stainless steel valves with replaceable plastic discs or seats. Line includes globe, Y, check, needle, and plug gate designs, and also packaged units. *Alloy Steel Products Co., Inc., Dept. HPAC, 1322 Elizabeth Ave., Linden, N. J.*

▸ *STAINLESS TUBING*—New technical data card describes high temperature properties of manufacturer's "Croloy 25-12 (309)" stainless tubing, its chemical composition, size ranges, short time tensile and rupture properties. Stainless tubing available in wide range of welding fittings. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, 712 Eleventh St., Beaver Falls, Pa.*

▸ *TABLES AND FORMULAS*—New booklet, "B3677D" contains 120 pages of tables, formulas, graphical symbols summarizing electrical data, properties of materials, heat transfer and steam information, measurements, other subjects. *Westinghouse Electric Corp., Dept. HPAC, Box 2099, Pittsburgh 30.*

RECENT TRADE LITERATURE

Continued

▸ *TEMPERATURE TRANSMITTER*—is featured in specification "P514" which details helium gas-filled system for measuring temperature and transmitting pneumatically to indicating, recording, and or controlling equipment at remote stations. *Bailey Meter Co., Dept. HPAC,* 1050 *Ivanhoe Rd., Cleveland* 10.

▸ *THREE-PHASE MOTORS*—Bulletin "GEA-6932" describes manufacturer's integral hp, 3-phase motors for fan, blower, compressor applications. Illustrated publication includes description of product features motor ratings, connection diagrams. *General Electric Co., Dept. HPAC, Schenectady* 5, *N. Y.*

▸ *TUBE PROTECTORS*—that extend usable life of old condenser and heat exchanger tubes and increase life of new tubes are detailed in illustrated bulletin "P-335". Design features and size specifications included. *Crane Packing Co., Dept. HPAC,* 6400 *Oakton St., Morton Grove, Ill.*

▸ *TUBE WELDING*—recommendations summarized in data card "TDC-155" providing information on suggested preheat and postheat treatments as well as proper type of electrodes. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC,* 712 *Eleventh St., Beaver Falls, Pa.*

▸ *TURBINE PUMPS*—vertical type which maintain high efficiencies over wide operating ranges, assuring continual and efficient service under variety of accidental conditions are described and illustrated in bulletin No. "2400-BI" containing efficiency charts and design features. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

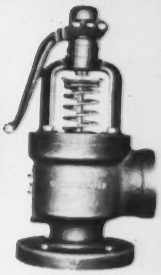
▸ *UNDERFEED STOKER*—as illustrated in catalog No. "401", is built for heavy duty service in boilers of about 20,000 to 34,000 lb of steam per hr capacity. *Detroit Boiler Co., Dept. HPAC,* 1510 *E. First St., Monroe, Mich.*

▸ *VERTICAL HEATERS*—as described in catalog "2659" are illustrated along with technical data, mounting heights, spread circle diameters, unit capacities of 30 sizes, specifications and dimensional drawings. *Young Radiator Co., Dept. HPAC,* 709 *S. Marquette, Racine, Wisc.*

Heating and Air Conditioning

OVERPRESSURE CONTROL

CONSOLIDATED SAFETY VALVES GIVE POSITIVE *PROTECTION*



Type 1511 Safety Valve. Cast iron body. Maximum capacity for saturated steam. Sizes: 1½" through 6". Pressures to 250 psi. Temperatures to 450° F.

Make certain steam, air and gas pressures are held within safe limits on your heating, piping, and air conditioning projects. Consolidated Safety Valves automatically relieve overpressures in everything from package-type boilers and large steam generators to air tanks and other unfired pressure vessels. A 2100-pound design boiler is used to test and set these valves—to guarantee capacities and assure the best protection. Typical plus values of Consolidated Safety Valves are exemplified in the Type 1511:

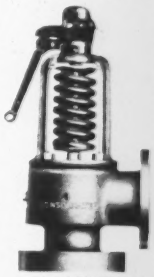
Compactness saves space and headroom; permits the use of smaller, more economical discharge piping.

Lower Cost per pound of steam discharged because maximum capacity is designed into minimum flange size. Fewer or smaller safety valves can be used on a boiler.

Better Alignment through double-guided adjusting ring and disc guide assures easier, more uniform blowdown adjustment and control, and finer operation.

Positive Tightness is created because the seat is machine-lapped to optical flatness.

On large or small installations, spring-loaded Consolidated Safety Valves give positive protection to personnel and facilities. Whatever the working pressures and temperatures of your heating, piping and air conditioning projects, choose Consolidated. Precision-made with few working parts, they are tough, long-life safety valves that rarely require maintenance. *Write for Catalog 700A.*



Type 1415 Safety Valve. Cast steel body. High capacity for saturated and superheated steam. Sizes: ½" through 6". Pressures to 900 psi. Temperatures to 900° F.

Type 1551 Safety Valve. Bronze body. For steam, air, gas. Sizes: ⅜" through 3". Pressures to 300 psi. Temperatures to 450° F.

ASME Standard • ASME Tested • National Board Certified

MAXWELL MANNING MM&M TRADE MARK

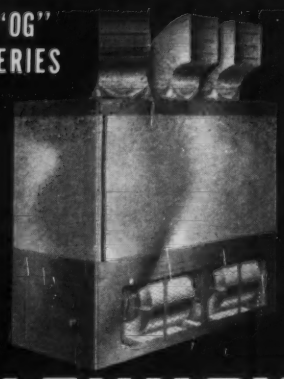
CONSOLIDATED SAFETY VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

"OG" SERIES



LENNOX

brings a

New Era

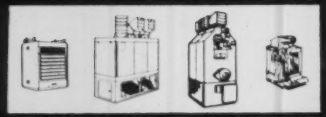
to Industrial Heating

- One Unit for Space Heating, Ventilating, Make-Up Air, Oven Applications and Drying
- Gas, Oil or Combination Burners
- Automatic or Manual Fuel Selection

Never before has one heater handled so many jobs so well, at such a sensible cost.

Completely proven and tested, the "OG" series can be used as a central system . . . with ducts . . . or as a unit heater. Installation may be horizontal, vertical, suspended or floor mounted. Dynamically balanced blower delivers a huge volume of air . . . with super-quiet action. But this just begins the "OG" story . . . write for full specs . . . see for yourself how Lennox has made the basic change in industrial heating.

LENNOX "Task Matched" Equipment to control and condition air for industry



64,000 to 2,000,000 Btuh Units

CLIP AND MAIL FOR FREE SPEC SHEETS

LENNOX Industries Inc.
INDUSTRIAL DIVISION
1701 East Euclid, Dept. HP-9
Des Moines, Ia.

Please send me—without obligation—complete specifications and engineering data on Lennox "OG" Series Industrial Heaters

Name_____

Company_____

Address_____ City_____

Title_____

RECENT TRADE LITERATURE

Continued

▶ *VALVES*—of conventional screwed and flanged as well as threadless types for soldered or silver brazed connections are shown in new circular detailing valves with pressure ratings from 125 through 300 psi. *Fairbanks Co., Dept. HPAC, 393 Lafayette St., New York 3.*

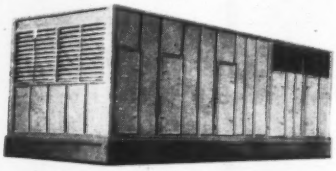
▶ *VENT VALVES*—for steam heating systems are illustrated with mechanical features, various uses, installation data. *Gorton Heating Corp., Dept. HPAC, Cranford, N.J.*

▶ *VIBRATION RECORDER*—Bulletin "K12A" describes "Vibrograph," hand-size instrument which tape records machine vibration amplitude. Recordings indicate bearing or cutting tool wear. *Korfund Co., Inc., Dept. HPAC, Long Island City, N. Y.*

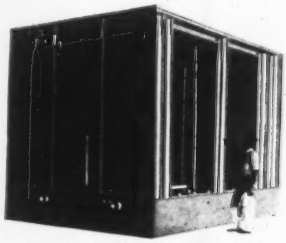
▶ *WATER HEATER TANKS*—of aluminum for commercial and industrial applications are described and specific uses illustrated in new brochure which includes sizing guide and tables for 23 different applications. *Aluminum Co. of America, Dept. HPAC, 780 Alcoa Building, Pittsburgh 19.*

▶ *WATER TREATMENT*—is dealt with in new bulletin "AQ59" which includes hints on corrosion and scale prevention, problems of closed circulating systems, and control of slime and algae. *Water Service Laboratories, Dept. HPAC, 615 W. 131st St., New York 27.*

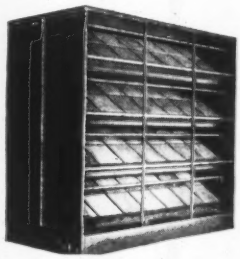
▶ *WELDING FITTINGS AND FLANGES*—in new bulletin "FDC-260" of nominal 3½ in. pipe size including dimensional and physical data. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*



ARTICULATED AIR CONDITIONING UNITS



SPRAY TYPE AIR WASHERS



CAPILLARY® AIR WASHERS

A&R

PRODUCTS
For Air Conditioning
Write for catalog

To —
AIR & REFRIGERATION CORPORATION
439 MADISON AVENUE
NEW YORK 22, N. Y.

®TRADEMARK REG.

WHO'S WHAT . . .

(New personnel, promotions)

▸ *JOHN WOOD CO., HEATER & TANK DIV.*—W. Glen Oslin, vice president and general manager, Conshohocken, Pa. factory; M. N. McIlwain, vice president & general manager, Chicago factory; Victor Mauck, Jr., factory manager, Conshohocken, Pa.

▸ *SIMPSON ELECTRIC CO.*—Mel Buehring, director of sales; William Johansen, sales manager of instrument division; William Coon, technical assistant to president; Peter De Paulo, director of engineering.

▸ *ADAMS MFG. CO.*—William S. Cope, sales manager.

▸ *SWARTWOUT CO.*—John D. Weber, vice president and manager of AutroniC Div.

▸ *ROBERTSHAW-FULTON CONTROLS CO.*— D. Rex Scott, general manager of Western Research Center in Anaheim, Calif.

▸ *VALLEY ENGINEERING CO.*—M. Bukowitz, chief project engineer.

▸ *BRISK METAL PRODUCTS*—George W. Minds, Jr., joined sales staff.

▸ *REPUBLIC APPLIANCE CORP.*—William P. Lennon, president; Fred Fowler, executive vice president and director; Oscar Shabot, vice president and director; Gordon Copeland, vice president and director.

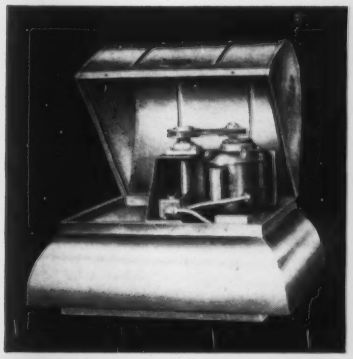
▸ *W-K-M DIV. of ACF INDUSTRIES*—C. Ross Spencer, manager — special projects.

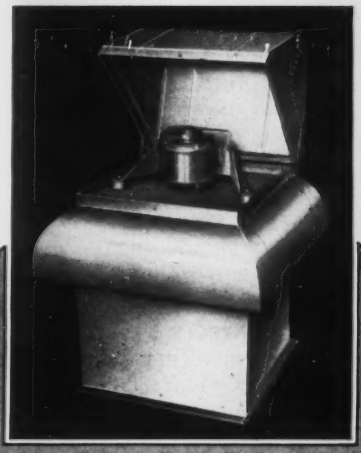
▸ *THOR POWER TOOLS CO.*—Robert B. Shulters, director of engineering at Aurora (Ill.) Works.

▸ *ANSUL CHEMICAL CO.*—William R. Rinelli, General manager, chemical products div.

▸ *GLEN ALDEN CORP.*—Harold A. Ketchum, executive assistant to the president; Rocco J. DiFonso, treasurer.

▸ *J. G. WHITE ENGINEERING CORP.*—Wilson C. Rich, Jr., chief process engineer.





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AIR HANDLING EQUIPMENT

ROOF VENTILATORS

- **THIRTEEN SIZES**
- **SELF CONTAINED**
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ALADDIN Type V Roof Ventilators are available in a complete range of sizes . . . direct and belt driven. Units can be furnished in both curb mounted or extended base types. Ruggedly built, the type V units have been designed for those installations where positive year around powered ventilation is required, and when properly installed, will give years of efficient trouble free service.

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- [x] CONDENSERS
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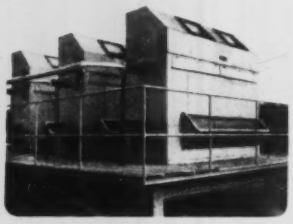
- [x] AIR HANDLING UNITS
- [x] SHELL & TUBE COOLERS
- [x] "ECLIPSE" COMPRESSORS
- [x] HEAVY-DUTY COMPRESSORS
- [x] QUICK-FREEZING SYSTEMS
- [x] "INSTANT" WATER COOLERS
- [x] MULTI-STAGE COMPRESSOR SYSTEMS
- [x] LOW PRESSURE REFRIGERATION UNITS
- [x] AUTOMATIC CONTROLS & DEFROSTING SYSTEMS
- [x] [x] COMPLETELY ENGINEERED SYSTEMS, DELIVERED AND INSTALLED



Frick Evaporative Condensers Save Up to 95% of the Water Used.

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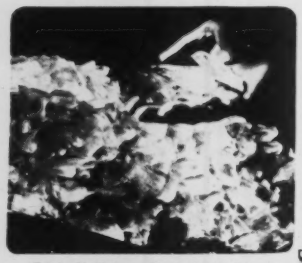

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CALL *your nearest Frick Branch or Distributor today. Or write direct to . . .*

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA., U. S. A.

WHO'S WHAT

Continued

▸ *EMBASSY STEEL PRODUCTS, INC.*—Bruce Botway, district sales manager.

▸ *DAYTON RUBBER CO.*—A. L. Schriml, product sales manager.

▸ *CHICAGO NIPPLE MFG. CO.*—Frank Deiderich, manager of sales.

▸ *WHITE-RODGERS CO.*—James A. Rodgers, Jr., manager of Technical Sales Division.

▸ *UNIVERSAL INSULATING MACHINE CO.*—H. Glen Woten, president and general manager; Jack Doty, sales manager for universal insulation blowing machines.

▸ *FISHER & PORTER CO.*—A. R. Hughes, special projects engineer.

▸ *KEASBEY & MATTISON CO.*—S. R. MacWhinney, merchandising manager of asbestos-cement pressure pipe.

▸ *BALTIMORE AIRCOIL CO., INC.*—Ben M. McDougall, field sales manager.

▸ *NATIONAL INDUSTRIAL ADVERTISERS ASSN.*—Harold A. Harty, chairman of board, Wolverine Tube.

▸ *DRESSER MFG. DIV., DRESSER INDUSTRIES*—Theodore A. Short, sales promotion manager.

▸ *CLAYTON MARK & CO.*—Howard M. Sullivan, manager of merchandising.

▸ *ALLIS-CHALMERS MFG. CO.*—John L. Wiedey, marketing manager, Pittsburgh works; George W. Hanafee, manager of Indianapolis district.

▸ *KRITZER RADIANT COILS, INC.*—E. M. Peterson, sales and engineering staff.

▸ *BARBER MFG. CO.*—Wilbur J. Priver, sales manager; Don S. Daniels, executive vice president.

▸ *BEAVER PIPE TOOLS, INC.*—E. J. Cassella, vice president of manufacturing; Donald W. Lininger, assistant sales manager.

WHO'S WHAT

Continued

▶ *RECOLD CORP.*—Leo J. Munchhuf, advertising and sales promotion manager.

▶ *RHEEM MFG. CO.*—Richard C. Perry, national product manager of commerical water heaters.

▶ *AMERICAN METAL PRODUCTS CO.*—R. Lisson, manager of market research, Davis Engineering Div.

▶ *BOILER ENGINEERING & SUPPLY CO., INC.*—Russell E. Emrich, Sr., president and chief executive officer; Russell E. Keen, chairman of board and assistant treasurer; Donald R. Keen, secretary-treasurer; Walter B. Riley, vice president and director of sales; William W. Palm, vice president and member of board; Russell E. Emrich, Jr., assistant secretary.

▶ *BONNEY FORGE & TOOL WORKS*—Joseph M. Potts, president.

▶ *CLEAVER-BROOKS SPECIAL PRODUCTS*—R. W. Goeldner, chief engineer.

▶ *BABCOCK & WILCOX CO.*—George W. Kross, Jr., assistant manager, tubing operations, Tubular Products Div.

▶ *PITTSBURGH PLATE GLASS CO.*—Elmer C. Larsen, director of commercial development dept.

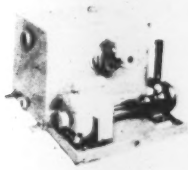
▶ *A. O. SMITH CORP.*—Earl Van Galder and Ralph S. Groves, Jr., sales representatives for Permaglas Division water softener program.

▶ *TITUS MFG. CORP.*—Berwyn Johnson, research engineer, research and development laboratory.

▶ *ACME INDUSTRIES, INC.*—Walter M. Hassenplug, executive vice president; Henry R. Krueger, director of engineering.

▶ *H. K. PORTER CO., INC.*—Thomas H. Leggett, Jr., advertising manager; T. Bruce Cox, new product sales engineer.

▶ *WATER SERVICE LABORATORIES, INC.*—Daniel J. Larkin, staff of engineering department.



EAGAN EAGLE —For steam heating loads up to 8000 sq. ft. at 20 p.s.i. Does not require pit even though return lines are no more than one foot above the floor.

EAGAN HOT POT —Vertical submerged type pump with cast iron receiver. Motor and pump above receiver safe from flooding. Single and duplex construction. Models for loads up to 15,000 sq. ft. at 20 p.s.i.

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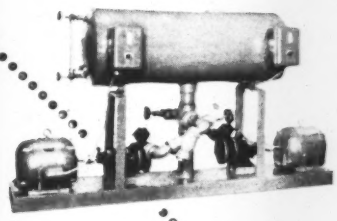
TYPE EC —Straight line arrangement requiring less floor space than necessary for competitive makes. Both pumps accessible for maintenance purposes. Single and duplex models designed for 2000 to 100,000 sq. ft. discharging against pressures of from 10 to 200 p.s.i.



EAGAN . . .

the complete line of Condensate Return Pumps

Eagan offers a full line of Condensate Return Pumps, and also manufactures Fuel Oil Pump and Heater Sets, Proportioning Pumps, Turbine Pumps and Centrifugal Pumps.

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Send me complete information on the EAGAN Line of Condensate Pumps.

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NEW LOW-COST TAYLOR TEMPERATURE TRANSMISSION

The new Taylor SENSAIRE* Temperature Transmitter provides low cost temperature measurement and pneumatic transmission to remote receivers and controllers, within limits of minus 30°F. to plus 1200°F. Simplified adjustments and excellent repeatability. Rugged, compact, force-balance, with mercury-filled system, it is self-compensating for ambient temperatures.

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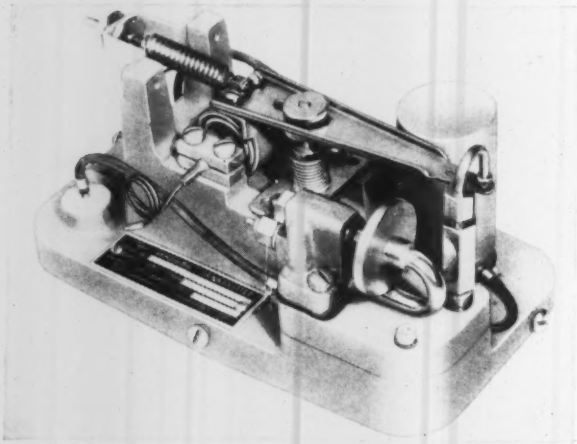
All SENSAIRE transmitters and components are interchangeable (regardless of range).

Write for SENSAIRE **Bulletin 98293**, or see your Taylor Field Engineer, Taylor Instrument Companies, Rochester 1, N. Y., or Toronto, Ontario.

*Trade-Mark



Operational simplicity in a rugged, compact unit.

Taylor Instruments

MEAN ACCURACY FIRST

WHO'S WHAT

Continued

▸ *COOPER ALLOY CORP.*—Edward A. Margus, assistant director of product engineering.

▸ *RIC-WIL, INC.*—S. C. Conn, vice president of finance.

▸ *NATIONAL-U. S. RADIATOR CORP.*—Roland A. Hazell, manager, National Steel Boilers, Heating and Air Conditioning Div.

▸ *U. S. FOREST PRODUCTS LABORATORY*—J. Alfred Hall, retiring as director; succeeded by Edward G. Locke.

▸ *LEWIS S. GOODFRIEND & ASSOC.*—Paul B. Ostergaard, senior engineer.

▸ *THE PHILIP CAREY MFG. CO.*—Frank W. Lippard, assistant manager of quality control div.

▸ *ARMCO STEEL CORP.*—William A. Frederick, superintendent, North Processing Dept., Butler Works.

▸ *DUNHAM-BUSH, INC.*—Henry E. Cardenas, product manager, marine dept.

▸ *BARNEBEY-CHENEY CO.*—Mrs. Mary P. Grossman, secretary-treasurer.

▸ *REVERE COPPER & BRASS, INC.*—John W. Eason, manager, Baltimore Div.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *ROBERTSHAW-FULTON CONTROLS CO.*—H. M. Summerell Co., sales representative for Virginia.

▸ *BALTIMORE AIRCOIL CO.*—Hugh B. Shepard, Maryland representative; Paller Engineering Co. to handle condensers and towers in central and northern Indiana.

▸ *RUBEROID CO.*—Culberg Asbestos, Chicago distributor; Insulation & Specialties, Inc., contractor and distributor in Bossier City, La., and El Paso and Odessa, Texas.

WHO'S WHAT

Continued

▸ *BAILEY METER CO.*—J. W. Cunningham, manager of Atlanta district office.

▸ *CEILCOTE CO.*—John G. Galloway, eastern sales manager; T. D. Skaggs, southeastern sales manager.

▸ *CUTLER-HAMMER, INC.*—O. P. Robinson, Cleveland sales manager; A. G. Turnquist, Pittsburgh sales manager.

▸ *WARREN PUMPS, INC.*—Howell Engineering Equipment Co., industrial sales representative in St. Louis area.

▸ *RECOLD CORP.*—International, Inc., wholesale distributor in San Antonio and Corpus Christi, Texas; Pearsall Co., representative in Colorado and southern Wyoming.

▸ *OHIO BRASS CO.*—James J. Langan, district manager for Pennsylvania, New Jersey, Maryland, Delaware, District of Columbia.

▸ *ATLAS VALVE CO.*—A. M. Seymour Assoc., sales representative in western New York State.

▸ *PYLE-NATIONAL CO.*—Curtis H. Stout, Inc., manufacturers representative in south-central area; D. W. Jackson, sales representative in Houston district office.

▸ *A. Y. McDONALD MFG. CO.*—Kenneth R. Krutchten, Kansas City branch manager.

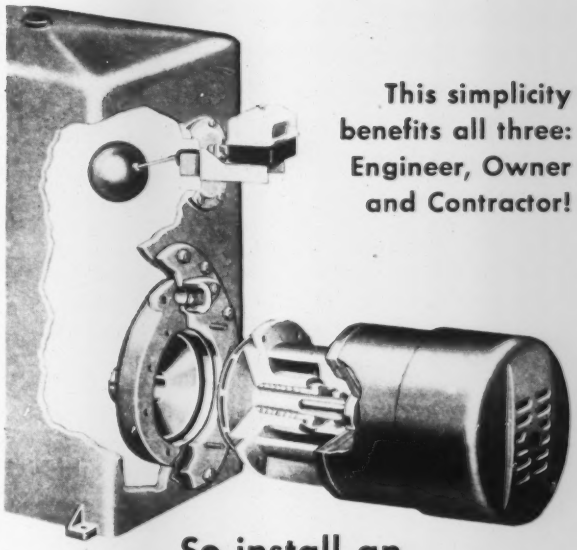
▸ *ROBERTSHAW-FULTON CONTROLS CO.*—new district sales offices at 21 Euclid Ave., Haddonfield, N. J.

▸ *KEROTEST MFG. CO.*—Weeks & Co., manufacturers agent for Maine, Massachusetts, Vermont, New Hampshire, Connecticut, Rhode Island.

▸ *LIMA REGISTER CO.*—Robert D. Bright, district manager for Ohio and surrounding states.

▸ *LEHIGH MFG. CO.*—Traco Industrial Corp., distributor for Metropolitan New York area.

▸ *OHIO INJECTOR CO.*—Carl G. Link, eastern regional sales manager; R. F. Dauenhauer, western regional sales manager.



This simplicity benefits all three: Engineer, Owner and Contractor!

So install an

AMERICAN-MARSH

Redi-Return Condensation Unit

CHECK THE CUTAWAY view above. See for yourself the simplicity and quality of the *Redi-Return*. You'll find this Condensation Unit better-built throughout.

EASY TO SPECIFY — The Engineer can select the most suitable unit from a full range of sizes with vertical or horizontal pumps, single or twin motor-pump units.

EASY TO INSTALL — The Contractor needs only to bolt unit in place, connect return line to inlet and discharge pipe to pump outlet and make electrical connections.

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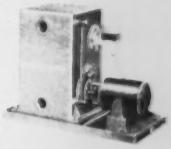
NUMEROUS TYPES, SIZES

Redi-Return Type CV



Redi-Return Type CHF

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Pumps and Pumps only Since 1873

Representatives in all principal cities. See our ads in C.E.C., ASME Catalogs

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, ETC.

WHO'S WHAT

Continued

▶ *TRANE CO.*—James A. Driver, heading new Orlando, Fla. sub-office; William F. Dudek, manager, sales office in Seattle.

▶ *DRAYER-HANSON DIV., NATIONAL-U. S. RADIATOR CORP.*—Climate Control Co., sales distributor for Spokane, northern Idaho and western Montana.

▶ *H. K. PORTER CO.*—Albert A. Kascsak, Jr., district manager, Force & Fittings Div., Tulsa territory to service Oklahoma, Kansas, New Mexico, west Texas.

▶ *YOUNG RADIATOR CO.*—R. A. Power, sales engineer, Chicago district office.

▶ *POWERS REGULATOR CO.*—George E. Fickett, vice president and general sales manager.

▶ *JOSEPH T. RYERSON & SON*—George H. Blank, sales manager, Buffalo, N.Y.

▶ *A. O. SMITH CORP.*—Robert N. Stime, assistant director of merchandising; Edward A. Lukowski, group merchandising manager.

▶ *CARRIER CORP.*—Victor C. Nelson, sales manager, Machinery & Systems Div.

▶ *OHIO FOUNDRY & MFG. CO.*—John R. MacDowell, sales manager.

▶ *ACF INDUSTRIES, INC.*—Robert O. Wynn, vice president of engineering & research; Henry C. Tooley, vice president of manufacturing, both with W-K-M Div.

▶ *DUNHAM-BUSH, INC.*—Frank D. Klein, product manager for air conditioning products.

▶ *PITTSBURGH CORNING CORP.*—Karl Baumler, manager of manufacturing.

▶ *CHASE BRASS & COPPER CO.*—Robert H. Chittim, handling special administrative assignments.

CAPITOL RECORDS BLDG.
LOS ANGELES, CAL.

WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

Capitalize on

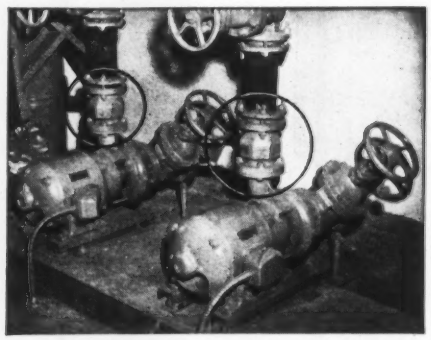
MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW. FACTORY MUTUAL LABORATORIES APPROVED.

SIZES 1" THROUGH 24".

FLANGED, ASA DRILLING, IBBM, CAST STEEL, ALL ALLOYS. FOR ALL FLUIDS AND GASES.

CERTIFIED MINIMUM PRESSURE DROP CURVE AVAILABLE



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MILLER VALVE CO., INC.

Pittsburgh 30, Pa. Plant—1620 Pennsylvania Ave.

WHO'S WHAT

Continued

Waterbury, Conn.; Payne C. Barzler, Jr., product manager-tube & fittings, Waterbury, Conn.; Homer D. Cebauer, district manager, Chase branch, Houston, Texas.

▶ *MORRISON PRODUCTS, INC.*—Al W. Kaufmann Assoc., representative for New York State, and New Jersey; S. Stewart Cavin Assoc., representative for Virginia, District of Columbia, Maryland, Delaware, eastern Pennsylvania, eastern tip of West Virginia; John Ott, handling remainder of West Virginia and western Pennsylvania; W. B. Knox, serving eastern Tennessee, North Carolina, South Carolina, Georgia, Alabama; Charles Hanson, representative in Miami, Florida, Caribbean; C. Rollins Brown, Jr., handling Arkansas, Louisiana, Mississippi, western Tennessee; Hepner Air Filter Service, Inc., representative for northeast Ohio; Eaton Air Filter Service Co., serving Michigan, except upper peninsula; James F. Whisler, representative for Illinois, except Chicago, Indiana, Kentucky; Sol Segal handling Missouri, Kansas, Iowa, Nebraska; Terrell J. Small, representative in Texas, Oklahoma.

▶ *SURFACE COMBUSTION CORP.*—Alfred L. Patmore, patent counsel.

▶ *CHELSEA PRODUCTS, INC.*—Albert E. Ott, vice president and sales manager.

▶ *RAWLPLUG CO., INC.*—Frederic B. Powers, Jr., secretary.

▶ *BRUNER CORP.*—Tom Kindred, manager, Texas Div. office.

▶ *PYLE-NATIONAL CO.*—Eugene P. Callahan, sales representative, Birmingham district office.

▶ *JOSEPH T. RYERSON & SON*—Thomas A. Edwards, manager, aluminum sales dept.

▶ *SOLAR AIRCRAFT CO.*—Manufacturers Sales Co., sales representative for Florida west of Apalachicola River; Duane Peabody Co., sales representative for Oregon and Clark County in Washington.

▶ *WOLVERINE TUBE DIV.*—Ray K. Mlodoch, sales representative, Chicago metropolitan area.

▶ *DUNHAM-BUSH, INC.*—E. Harold Brown, field sales engineer.

"...flexible modular construction; two bearings, lifetime lubricated; all panels removable; center hub rotors!..."*

* "...and packed with many more facts in a just-printed, 48-page catalogue about what D-H *now* offers you in its popular 30-model central station air conditioning units (horizontal and vertical). Handy time-saver fan performance curves included, too!" Contact direct for Engineering Manual No. CSHV 312, and name of Manufacturer's Agent nearest you. *Send for yours.*

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DIVISION NATIONAL U.S. RADIATOR CORP.

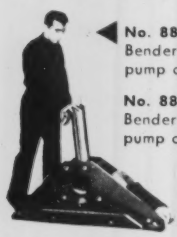
3301 MEDFORD ST., LOS ANGELES 63, CALIF.
CABLE: CLICONI, LOS ANGELES

FAST, LIGHTWEIGHT Hydraulic Pipe Bender for 1/2" - 3" pipe

full 90° bend with one ram stroke

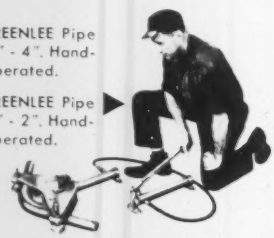
NEW GREENLEE No. 883 Bender saves hours, cuts costs on piping jobs. Gives you smooth, *accurate* bends right on the job exactly when and where needed. Has all these exclusive GREENLEE advantages for fast, easy *one-man* setup and operation:

- Bends these sizes of pipe: ½", ¾", 1", 1¼", 1½", 2", 2½", 3" . . . up to 90° with *one ram stroke*.
- Operates with either hand pump or portable power pump. Makes 90° bend in 3" pipe in only 10 minutes with hand pump . . . only 3 minutes with power pump.
- One set of rotating pipe supports for all eight pipe sizes. (Pipe supports also serve as rollers for wheeling bender from job to job.)
- Positive-locking pipe support pins cannot come loose.
- Pipe is easily inserted and removed from *front* of bender. Special pipe removal pin for simple release of pipe after bending.
- Bending gauge included for accurate results with minimum calculations. Identical bends easily reproduced.
- Compact, lightweight, portable . . . operates in any position.
- High-strength aluminum and steel construction for minimum weight, maximum strength.



◀ **No. 884** Lightweight GREENLEE Pipe Bender for pipe sizes ½" - 4". Hand-pump or power-pump operated.

No. 880 Lightweight GREENLEE Pipe Bender for pipe sizes ½" - 2". Hand-pump or power-pump operated. ▶



GREENLEE LINE OF TIMESAVING TOOLS FOR PIPE FITTERS AND PLUMBERS ALSO INCLUDES PIPE PUSHERS, HAND BENDERS, PLUMBERS' PIPE BITS, POWER BITS.

GREENLEE TOOL CO.
1769 Columbia Avenue, Rockford, Illinois

TOOLS FOR CRAFTSMEN — GREENLEE

WHO'S WHAT

Continued

▶ *TUBE TURNS DIV. CHEMETRON CORP.*—Eastern Pennsylvania Supply Co., Pennsylvania, distributor; John Hack Co., New Jersey, distributor; Empire Machinery & Supply Corp., Virginia distributor; Speakman Co., Inc., Del.-Md. distributor.

▶ *MUELLER BRASS CO.*—Alexander Hindmarsh, sales representative with Cambridge, Mass office.

▶ *JAMESBURY CORP.*—Karl Johnson, sales representative covering St. Louis, Kansas City area.

▶ *FRED H. SCHAUB ENGINEERING CO.*—H. V. Burton Co., representative in the Detroit area.

▶ *DAVIS ENGINEERING DIV., AMERICAN METAL PRODUCTS CO.*—Lawrence A. Nigro, New York district sales manager.

▶ *RITTLING CORP.*—William A. Slack, sales representative for Manhattan New York and West Chester County, New York.

▶ *OLIN MATHIESON CHEMICAL CORP.*—M. L. Foss, Inc., distributor in Colorado, Wyoming, and Black Hills area of South Dakota for Olin Aluminum Div.

▶ *MODINE MFG. CO.*—Staup & Harris Associates, Inc., sales representatives in Chicago territory.

▶ *IRON FIREMAN MFG. CO.*—Martin J. Wisehart, sales manager, Northwest Ohio and five counties in Indiana; William W. Suggs, Jr., sales manager, Columbus, O.

▶ *SPARKLER-FILTRION CORP.*—Industrial Steam, Inc., sales representative for eastern Wisconsin, upper Michigan.

▶ *AMERICAN STANDARD*—Sylvan E. Leinwand, eastern regional manager, Detroit Controls Div.

▶ *DRESSER INDUSTRIES*—Donald E. Miller, sales manager covering Michigan, northeastern Ohio and northern Indiana.

▶ *ALLIED METAL HOSE CO.*—Blair-Martin Co., Inc., representative in southern California. ±

WE HEAR THAT . . .

▸ *SOUTHWEST MANUFACTURING CO.* has purchased several acres adjoining their Aurora, Mo. plant.

▸ *CERRO DE PASCO CORP.* announced that its *LEWIN-MATHES CO. DIV.* was undertaking a copper and brass tube mill modernization program. Changes and installations will require about two years.

▸ *YORK DIV. of BORG-WARNER CORP.* has established 24 renewal parts depots to serve its engineered machinery equipment.

▸ *RELIANCE ELECTRIC & ENGINEERING CO.* has purchased a 41,000 sq ft plant on 23 acres at a site in Stratford, Ontario.

▸ *FISCHER & PORTER CO.* has announced formation of an autonomous company, *WARMINISTER FIBERGLASS CO.*, for the production of glass fiber reinforced plastic parts. The new company will be located next door to the Hatboro, Pa., parent company.

▸ A sales training program at the *YOUNGSTOWN SHEET & TUBE CO.* for graduates of colleges and universities has been started by the firm. It will cover 45 weeks combining classroom work with plant and field experience.

▸ *CALGON CO. DIV. OF HAGAN CHEMICALS & CONTROLS, INC.* has begun building a 25,000 sq ft extension to its research facilities. It will be completed this fall.

▸ *TITAN MFG. CO.* merged with its parent company, *CERRO DE PASCO CORP.*, effective July 1, 1959.

▸ *ARMCO CORP.* announced installation of a 565-ft long production line at its Middletown Works. It is expected to virtually double capacity for production of coated grades of sheet and strip.

▸ *JOSEPH T. RYERSON & SON, INC.* has added aluminum to its stocks and appointed *EDWARD D. VERKERK* head of its aluminum sales dept.

▸ *LENZ CO.* doubled plant capacity by its building expansion program.

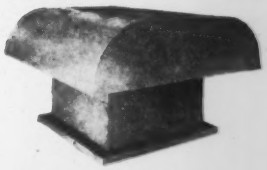
▸ *WATER TUBE BOILER & TANK CO.* recently dedicated its new 57,000 sq ft boiler manufacturing

Reed®
INDUSTRIAL FANS
TOP QUALITY PERFORMANCE

POWER ROOF VENTILATORS

MUSHROOM TYPE
DIRECT AND BELT DRIVE

Blade diameters from 12 in. to 60 in. • Static Pressures up to one inch water gauge • Air capacities to 50,000 CFM • Fan section insulated from housing • Ball bearings throughout • Hood can be raised from either end • Truly reversible air flow with equal performance in either direction also available.



new low silhouette

All Reed products are top quality, heavily constructed and built for a lifetime of heavy duty. No riveting is used, but electro-weld and interlocking seam construction throughout.

TUBEAXIAL FANS

DIRECT DRIVE
AND BELT DRIVE

Wide range of air deliveries up to 76,000 CFM and static pressures to 6 inch W.G., tailor-made to your air moving problems. 9 to 60 inch diameters, 2 to 13 blades, heavy all-welded construction. Special finishes available.

REED UNIT-FANS, INC.
501 North St. Patrick Street • New Orleans 19, La.
25 Years of Quality Fan Construction
Member Air Moving and Conditioning Assn. Inc. (AMCA)

WE HEAR THAT

Continued

plant. The new plant is located at 4343 S. Oakley, Chicago.

▶ *DRAYER HANSON DIV. NATIONAL U. S. RADIATOR CORP.* is erecting a one story, 1500 sq ft building to consolidate process engineering, production control and scheduling departments. Occupancy is expected within three months.

▶ *NATIONAL U. S. RADIATOR CORP.* recently presented engineering scholarships to George A. Mostoller for Johnstown College, William G. Reed and Mark Heilman for Pennsylvania State University.

▶ *ROPER INDUSTRIES, INC.* has acquired controlling interest of *O. E. SZEKELY & ASSOC.* The company will be reorganized and the name changed to *O. E. S. CORP.*

▶ *CLEAVER-BROOKS CO.* has expanded the administrative, sales and engineering offices of its subsidiary, *SPRINGFIELD BOILER CO. F. W. HAINER* has been named president of the subsidiary.

▶ *GENERAL CONTROLS CO.* held its annual heating controls training course for field representatives from 14 U. S. cities and Toronto, Ontario, Canada.

▶ The U.S. Patent Office has awarded a patent to *D. D. WILE*, vice president and chief engineer, and *ZHIZUO ROBERT ADACHI*, chief engineer for refrigeration products, of *RECOLD CORP.* The patent covers the "RE" unit room air conditioner.

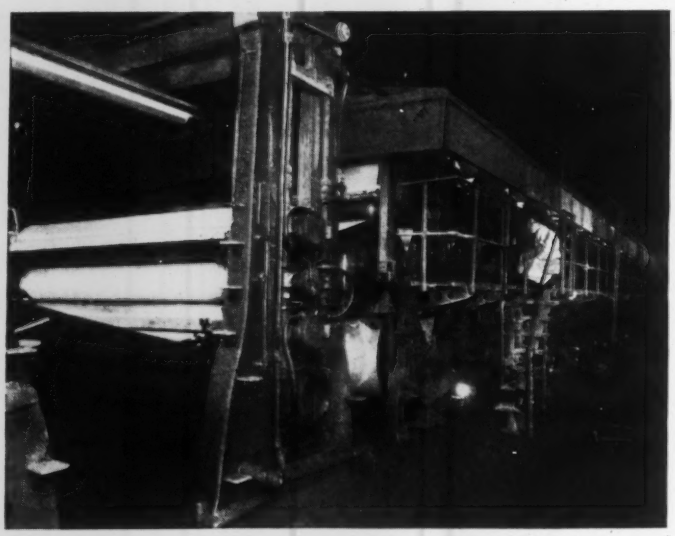
▶ *HERMAN NELSON UNIT VENTILATOR PRODUCTS DIV. of AMERICAN AIR FILTER CO.* is using an all-aluminum trailer to demonstrate school heating, ventilating and air conditioning to school boards in the eastern states.

▶ *JOSAM MANUFACTURING CO.* and *JOSAM PRODUCTS FOUNDRY CO.* recently became consolidated with the *BERLIANA CORP. JOSAM* will continue under present management and policies.

▶ *WHITE-ROGERS CO.* has formed a technical advisory group. The group will disseminate technical product information from general offices to the sales force.

Quick case history—reading time 58 seconds

How Hagafilm® stopped pipe corrosion, reduced daily fuel costs at WHIPPANY PAPER BOARD COMPANY



THE PLANT: One of the nation's largest producers of paper board and cardboard, Whippany Paper Board Company's Clifton, New Jersey plant uses secondary steam to progressively reduce moisture content in their products during manufacture. Steam is used to heat the more than 20 rolls in each paper machine to effect this drying.

THE PROBLEM: High corrosive action of the steam necessitated replacement of 18-20 pipe nipples *every three weeks*, raised maintenance costs. Corrosion deposits in pipes impeded heat transfer effectiveness, increased fuel costs. Steam traps frequently clogged.

THE SOLUTION: Hagafilm. Since introduction of Hagafilm into boiler feedwater system three years ago, no pipe nipples have needed to be replaced due to corrosion. Because Hagafilm treatment cleaned out old corrosion deposits, the surface temperature of the dryer rolls increased about 20°F. Steam trap clogging no longer fouls up plant operation.

TEST RESULTS: Hall Laboratories engineers, testing the system, had to wait five months before testing strips showed enough corrosion to even be measured. After five months, the strip located at the turbo-generator outlet showed the extremely low corrosion rate of 0.4 mg/dm²/day (.00007 IPY). The strip at the steam trap discharge had an equally low corrosion rate of 1.4 mg/dm²/day (.00025 IPY).

FOR FULL INFORMATION on how Hagafilm can help in your plant operation by putting a thin protective film of metal surfaces throughout the condensate system, contact Hagan Chemicals & Controls, Inc.

HAGAN CHEMICALS & CONTROLS, INC.

DIVISIONS: CALGON COMPANY, HALL LABORATORIES

HAGAN BUILDING, PITTSBURGH 30, PA.

In Canada: Hagan Corporation (Canada) Limited, Toronto

THE PRESIDENT PROPOSES . . .

That you consider your space requirements for the Largest Exhibit and Conference of its kind to be held in 1960

THE WESTERN

AIR CONDITIONING, HEATING, VENTILATING AND REFRIGERATION

EXHIBIT AND CONFERENCE

SPONSORED BY THE AIR CONDITIONING INDUSTRIES ASSOCIATION

APRIL 27-30, 1960 • SHRINE EXPOSITION HALL • LOS ANGELES

Bill Tennity, President of the Air Conditioning Industries Association cordially invites you to participate in additional profits by exhibiting in the show that serves the fastest growing market in the world — the 13 Western States.

ART HESS SECONDS THE MOTION

The Vice-President of the Air Conditioning Industries Association and Chairman of the Technical Conference plans a comprehensive series of technical sessions, special clinics and seminars and designates —

- **ENGINEERS' DAY — APRIL 28**
- **CONTRACTORS' DAY — APRIL 29**
- **JOURNEYMEN'S DAY — APRIL 30**

It's a show you can't afford to miss!

WESTERN AIR CONDITIONING INDUSTRIES ASSOCIATION

RESERVE YOUR EXHIBIT SPACE NOW!

CONTACT:
FRED J. TABERY, EXHIBIT MANAGER
3443 SOUTH HILL STREET
LOS ANGELES 7, CALIF.
TELEPHONE: RIchmond 9-1091

WE HEAR THAT

Continued

▸ *JOSEPH T. RYERSON & SON, INC.*, of Charlotte, N.C., has added Reynolds aluminum to its stocks.

▸ The newly formed *NATIONAL INSULATION MANUFACTURERS ASSOCIATION* has established an Insulation Information Center in its New York City office. The Association headquarters are at 111 Lexington Avenue.

▸ *EXITAIRE CO.* has moved into new plant facilities. The 12,000 sq ft plant is located at 13650 Vaughn St. in Pacioma, California.

▸ *DANIEL D. WILE*, vice president and chief engineer of *RECOLD CORP.* addressed the 10th International Congress of Refrigeration on August 19. The Congress was held in Copenhagen, Denmark.

▸ *McQUAY, INC.* has announced an expansion program consisting of a 10,000 sq ft addition to its Fairbault, Minn. plant and a 60,000 sq ft addition to its Grenada, Miss. plant. Construction work on both plant additions is being started immediately.

▸ *CRANE CO.* has reduced the size of its board and increased its quarterly dividend by 50 percent. The board members include *THOMAS M. EVANS*, chairman. *ROBERT B. CRANE, ALFONS LANDA, E. A. LOCKE, JR., MARK LOWELL, ANTHONY VON WENING*, and *R. ARTHUR WILLIAMS*.

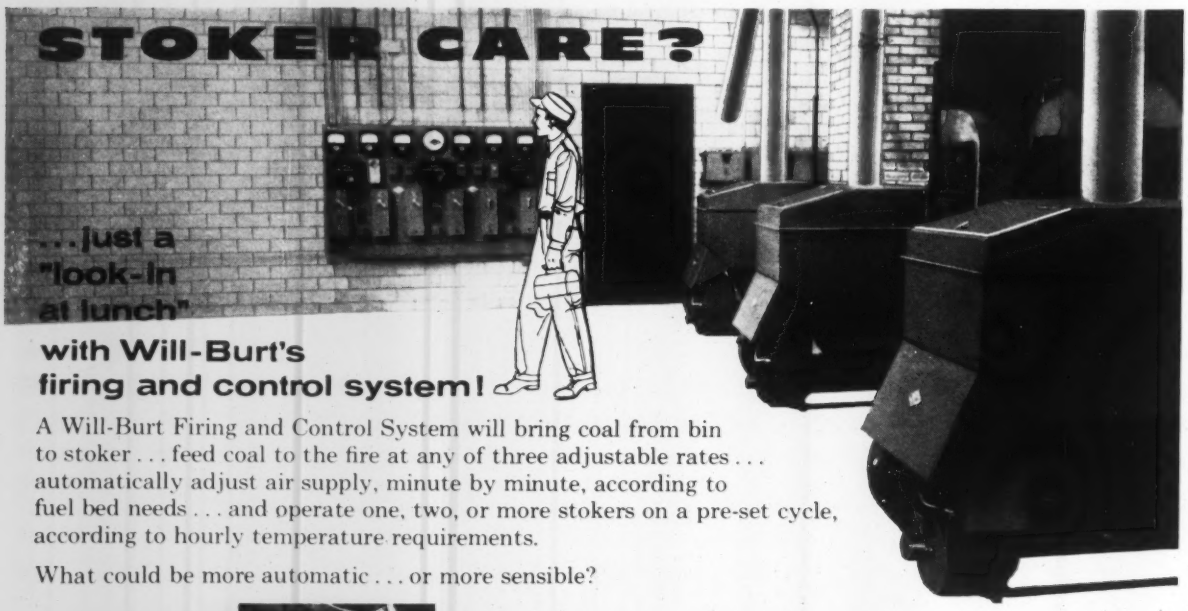
▸ A sales training course, over a 20 week period, was recently held in Dubuque, Iowa under the *PLUMBING-HEATING-COOLING INFORMATION BUREAU'S* initial sales training program.

▸ *RHEEM MANUFACTURING CO.* recently opened a new $500,000 plant at Maipu, Chili.

▸ Construction has started on an addition to the *SCHEMENAUER MFG. CO.* plant in Holland, Ohio. The new addition is expected to double manufacturing area.

▸ An extensive building program will expand the facilities of the *EUTECTIC WELDING ALLOYS CORP.* in Flushing, N.Y. The company is also erecting a new Foundry and Metallurgical Division at its European Welding Center in St. Sulpice, Switzerland.

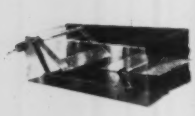
▸ *HAGAN CHEMICALS & CONTROLS, INC.* has announced that it will discontinue manufacture of aerostatic dust collectors.



with Will-Burt's firing and control system!

A Will-Burt Firing and Control System will bring coal from bin to stoker . . . feed coal to the fire at any of three adjustable rates . . . automatically adjust air supply, minute by minute, according to fuel bed needs . . . and operate one, two, or more stokers on a pre-set cycle, according to hourly temperature requirements.

What could be more automatic . . . or more sensible?



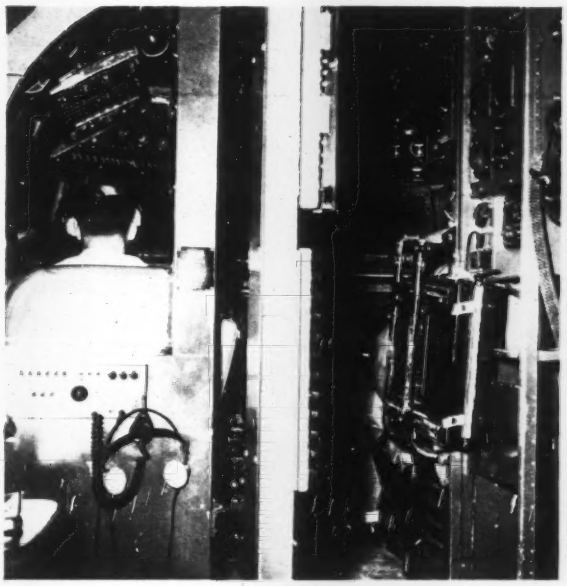
W-B Automatic self-adjusting Air Control . . . part of every W-B Stoker.

W-B Coal Conveyor . . . power-reversing to clear obstructions . . . operates at any angle.

WILL-BURT STOKER

Take our word for it, it's economical. Write direct — or ask your Will-Burt Stoker Specialist for bulletins and help on selection and installation.

WILL-BURT STOKERS • Orrville, Ohio



Interior view EAL DC-7 B simulator.

THERMAL

Helps Keep Pilots Cool

In a business where safety is paramount, pilot efficiency and equipment dependability are prerequisites. And, in the flight simulator building* of Eastern Air Lines in Miami, four big Thermal central plant units prove their dependability to provide year 'round comfort for flight personnel practicing instrument flying.

Thermal Engineering manufactures a complete line of air conditioning and ventilating equipment for every climate and to fit all architectural requirements. To see how easily, economically and efficiently Thermal equipment will fit into your new building or remodeling plans write for complete information on Thermal central plant and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils and air-cooled condensers.

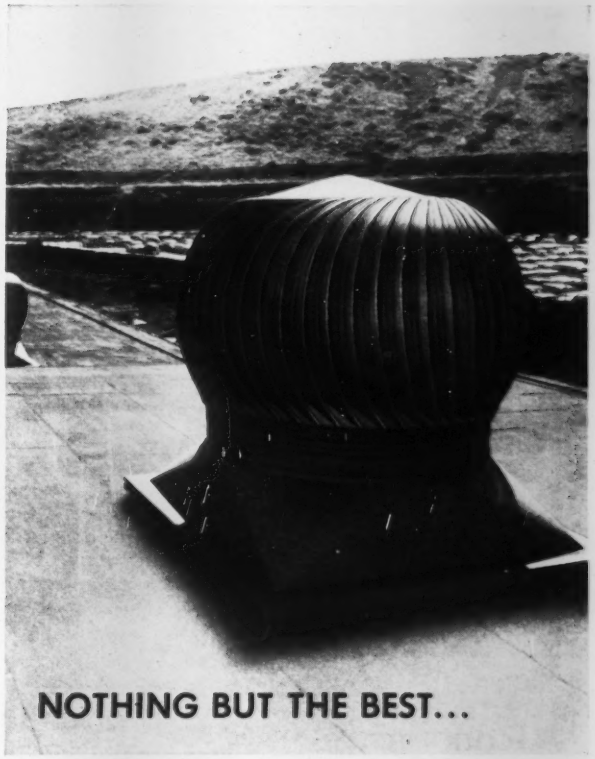
*Architects: Stewart-Skinner Associates, Miami
Consulting Engineers: R. L. Duffer & Associates, Miami
Thermal Agent: A. C. Dean Co., Miami

Agents in principal cities.

Quality Products Since 1945.

THERMAL ENGINEERING CORPORATION

2605 W. DALLAS • P. O. BOX 13254
HOUSTON 19, TEXAS



Western Rotary® Roof Ventilators

with Lifetime Guaranteed Bearings

- "Backward curved blower wheel" type mechanism assures high, constant exhaust capacity, no backdraft ever.
- Certified wind tunnel tests by non-commercial national institute.
- Unique factory lubricated sealed bearings are specially designed for positioning load, countering wind pressure, assuring stability.
- Lock-on rotor, yet removable without special tools.
- Exclusive Western corrugated vane increases rigidity.
- Low, functional type adds beauty.
- Baked enamel paint coating for beauty and long life.
- Aluminum, copper, or stainless steel construction available.

Other type ventilators include:

- Stationary
- Directional
- Continuous ridge
- Vertical exhaust
- Axial roof
- Unit ventilators

Immediate Delivery on all sizes

Complete Catalog in Sweets and Western States A-E-C

Write for catalog and name of nearest representative.

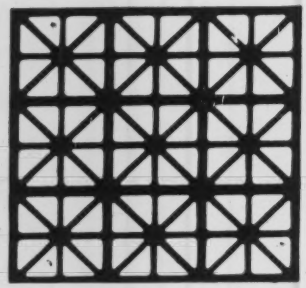
WESTERN ENGINEERING & Mfg. Co.

4108 Glencoe Avenue, Venice, California

Since 1921 . . . a reliable leader.

THINK OF HENDRICK for ARCHITECTURAL GRILLES

more than 100 designs to choose from

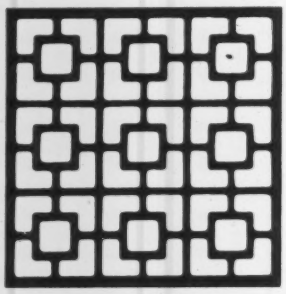


ATTRACTIVE

Hendrick Architectural Grilles combine the functional with the decorative. Many designs are obtainable only from Hendrick.

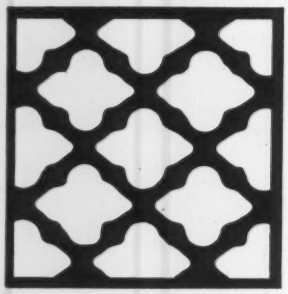
ECONOMICAL

Hendrick Grilles cost less to install and maintain than most architectural materials.



VERSATILE

Each design can be furnished in a wide range of dimensions, with varying numbers and sizes of perforations.



EASY TO INSTALL

Hendrick Grilles always lie flat . . . do not bend or warp. They provide more than enough room for free passage of air.

Write today for more information about Hendrick Grilles.

Hendrick
Manufacturing Company
48 Dundaff Street, Carbondale, Pa.

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Hendrick Wedge Wire Screens • Architectural Grilles • Micro Open Steel Flooring—Shur-Site Treads • Armorgrids • Hydro Dehazers • Distillation Chemical Column Internals

WE HEAR THAT

Continued

▸ *WESTINGHOUSE ELECTRIC CORP.* has completed one week courses for several hundred service men from distributor and dealer organizations in its Staunton, Va. plant.

▸ The *RAMSET FASTENING SYSTEM*, a division of *OLIN MATHIESON CHEMICAL CORP.*, has established a warehouse and office facilities in East Alton, Ill.

▸ *FRANKLIN PLASTICS, INC.* has announced purchase of *GULFSTREAM PLASTICS, INC.*, 3597 E. 10th Court, Hialeah, Florida. Franklin Plastics is a manufacturer of plastic pipe and fittings. Operating personnel will be: *DIXON P. DOWNEY*, president; *ROBERT J. LITZINGER*, vice president and resident general manager; *CHARLES W. MITCHELL*, president sales manager.

▸ The *NARDA ULTRASONIC CORP.* has expanded into a second building of its Westbury, Long Island, New York plant. The new building is a 10,000 sq ft one story structure at 50 Sylvester St., Long Island.

▸ *B. B. CHEMICAL CO.*, a subsidiary of *UNITED SHOE MACHINERY CO.* has announced new laboratory facilities. The Cambridge, Mass. laboratory will encompass 1600 sq ft of space.

▸ A new booklet for prospective authors, titled *Writing and Publishing Your Technical Book*, is available without charge from *F. W. DODGE CORP.*, 119 W. 40th St., New York 18, N.Y.

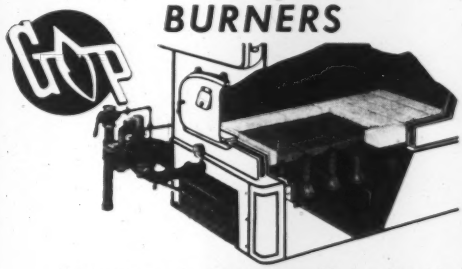
▸ In celebration of its 50th anniversary, *CHICAGO PUMP CO.* recently held a two day meeting and exhibit of new products in the LaSalle Hotel in Chicago.

▸ *KELCO METAL PRODUCTS CO.* has established an aluminum warehouse in Worcester, Mass.

▸ *CLEAVER-BROOKS SPECIAL PRODUCTS* has announced that *MARSHALL & SONS*, of London, England will manufacture and sell its products under a foreign license agreement. Marshall & Sons was named licensee for *CLEAVER-BROOKS CO.*, the parent corporation, for the manufacture and sale of packaged boilers in 1958.

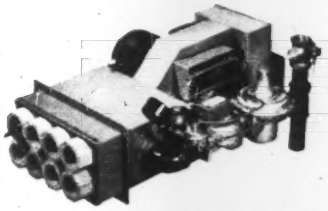
*"Planned Performance"**

BURNERS



For heating and power boilers. 23 sizes listed in Catalog No. A-10.

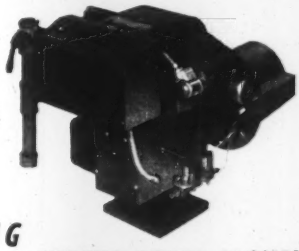
BLUE LINE UPSHOT ATMOSPHERIC GAS BURNER



Fully automatic, packaged assembly. Sizes listed to 28 million BTU/HR in Catalog C-10

TURBO-FIRE POWER TYPE GAS BURNER

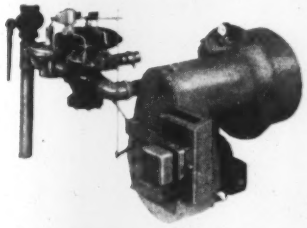
MODEL R
Capacities up to
2¼ million BTU/HR
Catalog E-61



TURBO-RING FORCED DRAFT BURNERS

Gas, oil, or combination Gas-Oil burner. No stack required on boilers equipped for pressure firing.

MODEL FGR
Capacities 1 to 9
million BTU/HR
Catalog E-51



* PLANNED — Factory assembled, pre-wired for "Bolt-in" installation.

* PERFORMANCE — Custom matched to individual boilers for quiet, efficient operation.

Gordon & Piatt also manufacturer of a complete line of domestic conversion burners plus large dual-fuel units. Write for literature and complete information.

Gordon & Piatt
P. O. Box 914
Winfield, Kansas

REDUCE piping costs . . . SPEED installation

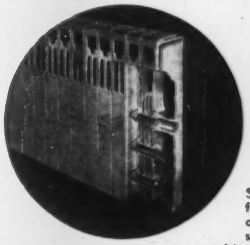
with

SHAW Radiators

Only Shaw, of all modern radiators, offers *same end* as well as opposite end tapping. Same end tapping has a place in almost every piping layout, and its use invariably means less piping materials, simplified pipe fitting.

Important savings in installation time are made with *any* Shaw model, regardless of tapping arrangement. Shaw units are compact, fully self-contained assemblies only 3" thick, easy to handle and mount. There are no dampers, or separate housings to fit and install.

Shaw Radiators distribute both radiant and convected heat in unvarying, health-guarding proportions that create natural thermal comfort in a room. They use either hot water or steam up to 150 psi. Write today for free literature on both panel and baseboard models.



Shaw Baseboard and Panel Radiators feature heavy gauge steel heating fins and box-type exterior radiant panels snugly fitted around the heavywall copper tubing. Tubing is then expanded slightly by 3750# hydraulic pressure to hold all components as a rigid, self-contained unit. The tight metal-to-metal bond assures rigidity and full heat conduction.

SHAW-PERKINS
MANUFACTURING COMPANY
201 East Carson St. • Pittsburgh 19, Pa.

MEETINGS & CONVENTIONS

1959

SEPT. 13—American Society for Testing Materials, Pacific area meeting. Sheraton Palace Hotel, San Francisco. For information contact: American Society for Testing Materials, 1916 Race St., Philadelphia 3.

SEPT. 21-25—Instrument Society of America, instrument-automation conference and exhibit, International Amphitheater, Chicago. For information contact: Fred J. Tabery, exhibit manager, Instrument-Automation Conference and Exhibit, 3443 S. Hill St., Los Angeles 7.

SEPT. 28-OCT. 1—American Welding Society, fall meeting. Sheraton-Cadillac Hotel, Detroit. Information: American Welding Society, 33 W. 39th St., New York 18.

SEPT. 29-OCT. 1—Western Region Conference of the National Association of Corrosion Engineers, annual meeting. Bakersfield Inn, Bakersfield, Calif., Information: National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

OCT. 5-7—American Gas Association, annual convention, Conrad Hilton Hotel, Chicago. Information: American Gas Association, 420 Lexington Ave., New York 17.

OCT. 5-8—Northeast Region Conference of the National Association of Corrosion Engineers, annual meeting, Lord Baltimore Hotel, Baltimore, Md. Information: National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

OCT. 19-23—47th Annual National Safety Congress and Exposition, Chicago. Conrad Hilton, Congress, Sheraton, Morrison, Palmer House, LaSalle Hotels. Information: National Safety Council, 425 N. Michigan Ave., Chicago 11.

OCT. 27-30—Insulation Distributor-Contractors National Association, Inc., annual convention. Flamingo Hotel, Las Vegas. For information contact: Insulation Distributor-Contractors Association, Inc., 1632 K St., N .W., Washington 6, D. C.

NOV. 1-6—Insulation Distributor-Contractors National Association, Inc., Mid-Pacific conference, Hawaiian Village Hotel, Honolulu. Information: Insula-

Write for new Bulletin!

WILSON
CENTRIFUGAL BLOWDOWN SEPARATOR

SOLVES BOILER BLOWDOWN DISPOSAL PROBLEMS

Here is the safe, economical way to handle boiler blowdown . . . at atmospheric pressure. Steam flash is instantaneously cleared through the large top vent pipe. Water and sludge fall by gravity through bottom drain. No objectionable noise. Install where convenient, inside or out—even on boiler room roof. One Wilson Separator can handle two or more boilers in battery, if desired. Special models with flanged or butt welding connections available.

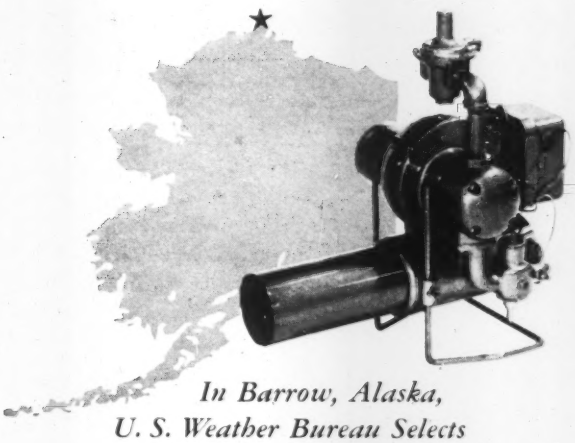
- MEETS REQUIREMENTS OF A.S.M.E. UNFIRED PRESSURE VESSEL CODE
- SIMPLE TO INSTALL
- REQUIRES NO MAINTENANCE
- THOUSANDS IN SERVICE

NEW AFTERCOOLER FOR HOT LIQUIDS

Effectively reduces temperature of blowdown before entering sewer. Easy to install. Requires no special connections.

WILSON ENGINEERING CORPORATION

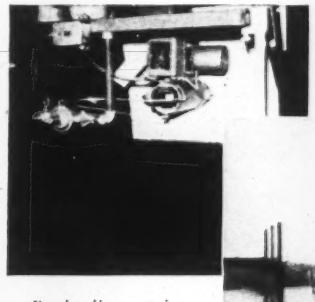
6 North Michigan Avenue Dept. H-7 Chicago 2, Illinois



In Barrow, Alaska,
U. S. Weather Bureau Selects

LO-BLAST ECONOMITE

POWER GAS CONVERSION BURNERS



Economite supplies heat for cooking as well as comfort on this converted range in hospital kitchen.

Feeder line crossing Nerrovik lagoon is cable-suspended.

Thirteen Economites and seven Dual Fuel Lo-BLAST Burners burn natural gas with trouble-free dependability to heat personnel housing, offices, warehouses, hospital, school and other buildings in the U.S. Weather Bureau Station, Barrow, Alaska.

Economite adds a bonus of *savings* over and above its dependability—averages 10% lower operating cost. Controlling primary and secondary air perfectly, it functions independently of variable natural drafts—is especially well-suited for down-draft boilers. Combustion is completed in an incandescent firebox, with radiant heat applied to crown sheet and side walls. Other features: soft, quiet-flame...standard controls with positive acting pilot and blower safetys...sturdy, fool-proof design...easy to install because completely assembled and factory-tested on gas.

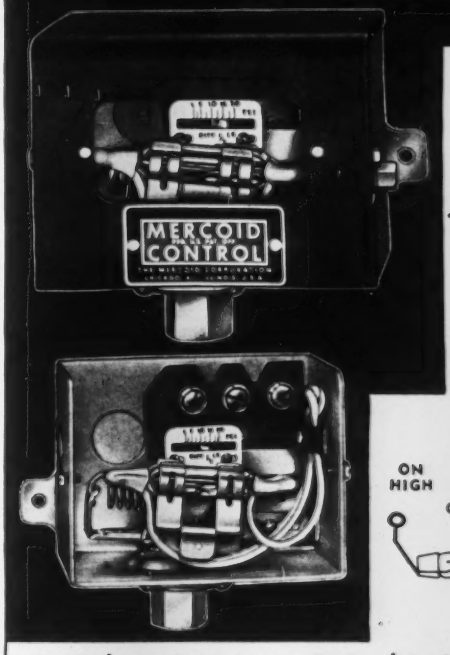
Lo-BLAST Power Gas Burners are available in 70,000 to 20,000,000 B.T.U. input capacities. Write for literature.

(Use of this product by a U.S. Government Bureau in no way constitutes an endorsement of the product by the Government.)

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

NEW Small, Lightweight

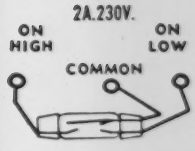
MERCOID®
PRESSURE CONTROL



WEIGHT 1¾ lbs.

OUTSIDE ADJUSTMENTS
VISIBLE CALIBRATED DIAL

SP-DT
4A.115V.
2A.230V.



For Mediums Not Injurious To Steel Or Silver Solder

Type AP-153 control incorporates a single pole, double throw Mercoid hermetically sealed mercury switch (4A. 115V., 2A. 230V.). The control will provide single pole cut-in high; single pole cut-in low, or single pole double throw operation.

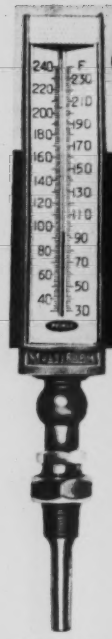
OPERATING RANGES

ADJUSTABLE OPERATING RANGE	SWITCH DIFFERENTIAL PSIG. With Pointer Set At		MAXIMUM LIMITS SURGE
	LOW	HIGH	
1 to 20 psig.	0.3	0.5	30 psig.
1 to 30 psig.	0.4	0.75	40 "

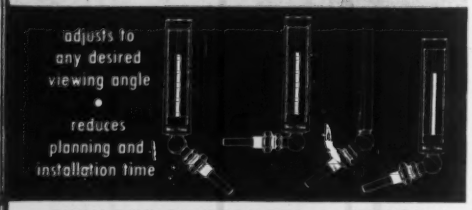
ADJUSTMENT: External.
PRESSURE ELEMENT: Fairprene diaphragm.
PRESSURE CONNECTION: ¼" I.P.S.
MOUNTING: Has two mounting ears (one on each side of control) or control may be pipe mounted by means of the ¼" I.P.S. bottom connection.
WIRING ENTRANCE: Two ½" openings
INTERNAL WIRING CONNECTIONS: 3 post terminal block.
SWITCH LEADS: Silicone rubber covered.
CASE: NEMA 1—Heavy gauge steel, cadmium plated. Steel cover (with glass front) finished in charcoal-gray.

WRITE FOR BULLETIN 02

THE MERCOID CORPORATION
4201 Belmont Ave., Chicago 41, Ill.
New York: 205 E. 42nd St. - Philadelphia: 3137 N. Broad St.



PRINCO MultiForm® THERMOMETER



NEW DESIGN REDUCES INVENTORY, AND ELIMINATES SPECIAL ORDERS

The new PRINCO MultiForm thermometer easily turns or tilts to the most favorable reading position after the stem is in place and is positively secured at that angle by PRINCO's exclusive tapered lock* construction. Provides a fast, accurate and dependable temperature check on industrial operating conditions and processes.

Other outstanding MultiForm features:

- minimizes engineering time; reduces inventory
- simplifies installation; easily positioned to by-pass piping
- two piece scale eliminates parallax, assures easy, accurate readings
- baked finish resists fumes and corrosive atmospheres

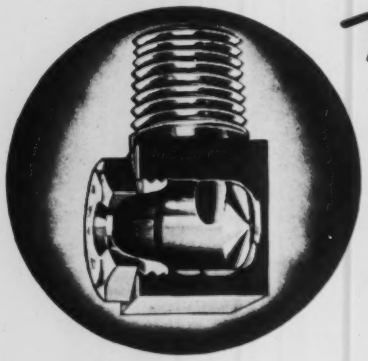
*Patent Applied For.

Available with any standard S.A.M.A. separable socket or with separable flange and perforated stem for installation in air ducts. Wide variety of ranges and graduations.

write, wire or call . . .
PRECISION THERMOMETER AND INSTRUMENT CO.
1434 Brandywine St., Philadelphia 30, Pennsylvania

PRINCO

LOcust 3-6671



Monarch

NOZZLES for AIR WASHERS

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from 1/8" to 1". 1/4" size is 1-5/16" long and made from 5/8" square stock.

Write for Catalog I

Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.

Canadian Agents: (Except B. C.)
E. S. Gallagher Sales Ltd., Toronto 12, Canada

MEETINGS & CONVENTIONS

Continued

tion Distributor-Contractors Association, Inc., 1632 K St., N.W., Washington 6, D. C.

NOV. 2-5—*Air-Conditioning and Refrigeration Institute*, 11th exposition. Atlantic City Auditorium, Atlantic City, N. Y. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D. C.

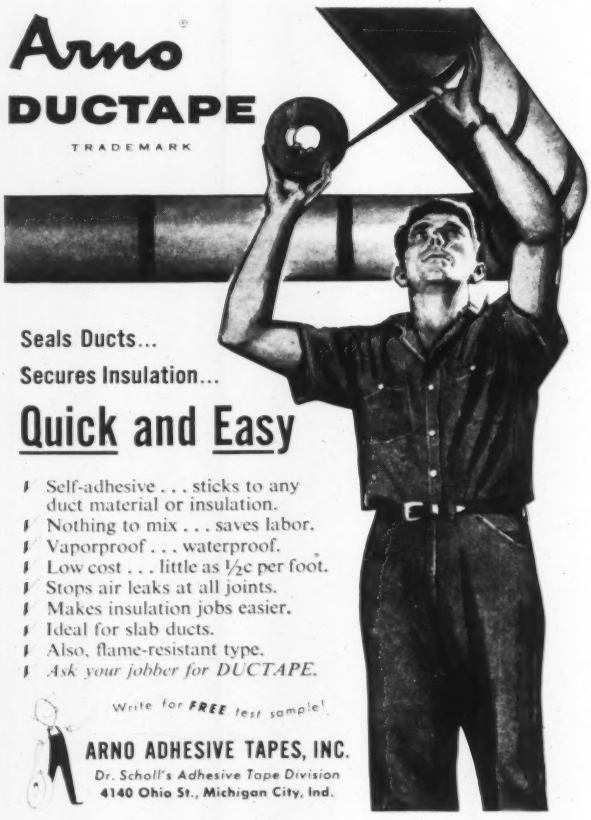
NOV. 16-20—*National Association of Corrosion Engineers*, annual general Florida conference and corrosion short course. Key Biscayne Hotel, Miami. Information: National Association of Corrosion Engineer, 1061 M & M Bldg., Houston 2.

DEC. 1-4—*National Warm Air Heating and Air Conditioning Association*, committee meetings and annual convention. Chase Hotel, St. Louis, Mo. Information: National Warm Air Heating and Air Conditioning Association, 640 Engineers Bldg., Cleveland 14.

1960

JAN. 25-28—*National Plant Maintenance and Engi-*

Arno® DUCTAPE
TRADEMARK



Seals Ducts...
Secures Insulation...

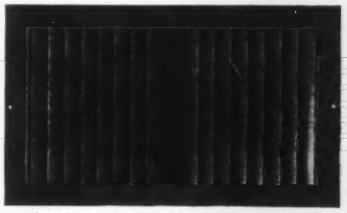
Quick and Easy

- Self-adhesive . . . sticks to any duct material or insulation.
- Nothing to mix . . . saves labor.
- Vaporproof . . . waterproof.
- Low cost . . . little as ½c per foot.
- Stops air leaks at all joints.
- Makes insulation jobs easier.
- Ideal for slab ducts.
- Also, flame-resistant type.
- *Ask your jobber for DUCTAPE.*

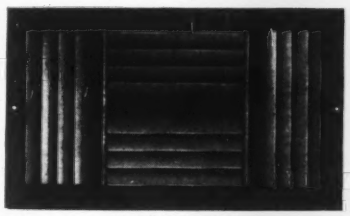
Write for **FREE** test sample!

ARNO ADHESIVE TAPES, INC.
Dr. Scholl's Adhesive Tape Division
4140 Ohio St., Michigan City, Ind.

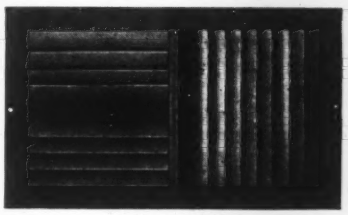
NEW FROM A-J!



A-J 200 AIF



A-J 200 CF



A-J 200 BF

No. 200 SERIES CEILING DIFFUSERS

with 18 different deflection patterns!

Have a special air distribution problem? Solve it quickly, easily, economically with an A-J No. 200 Series Ceiling Diffuser.

Extruded aluminum curved blades provide maximum air control with minimum resistance. Adjustable face bars are 1¼" wide on ¾" centers. You can have your choice of multiple valves (No. 230) or opposed blade dampers (No. 240). Available in either sturdy steel or extruded aluminum frames. Platinum enamel is standard finish.

Write for FREE copy of our catalog.

A-J

A-J Manufacturing Co.

Dept. H-9 3601 East 18 Street Kansas City 27, Missouri

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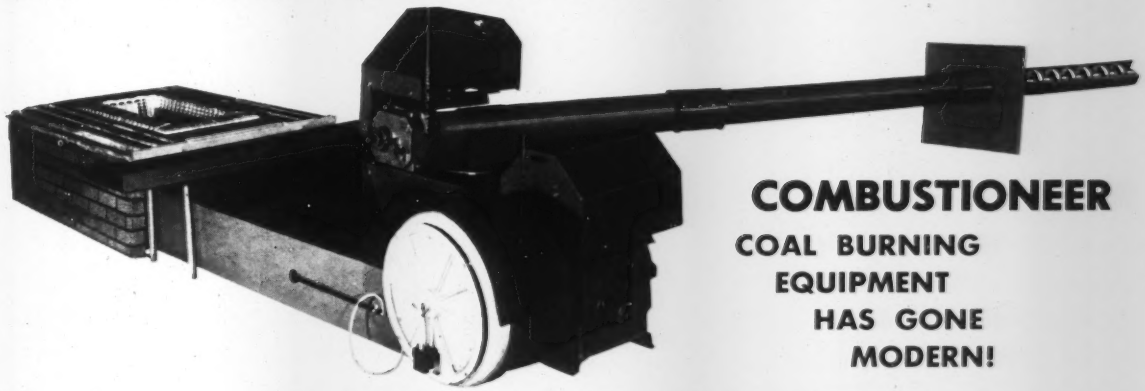

COMBUSTIONEER

COAL BURNING EQUIPMENT HAS GONE MODERN!

AS SHOWN ABOVE IN COMBUSTIONEER'S UNIQUE UNIVERSAL BIN FEED STOKER.

A new concept in equipment offering greater flexibility of arrangement in new or existing boiler room design. There is a modern combustioneer coal burning unit available today for all domestic-commercial and industrial applications. Write for complete data.

AUTOMATIC SOLID FUELS EQUIPMENT, INC.

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Original combustioneer factory parts for all models readily available.

Economy is demanding the "swing to coal".

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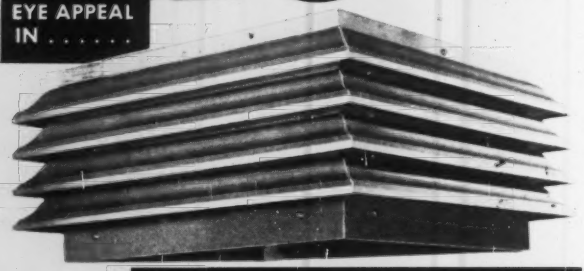
PLEASE PRINT — NAME

BUSINESS NAME

ADDRESS

CITY ZONE STATE

ALL FUNCTIONAL FEATURES PLUS EYE APPEAL IN . . . . . Low Silhouette



WAUSAU AIR MOVER

- MODERN DESIGN — Aluminum Extrusions designed to permit low outlet velocities . . . housing completely weatherproof.
- NO UNSIGHTLY CURB MOUNTINGS — Point of Discharge used in design makes unsightly curb mountings unnecessary.
- MORE RIGID WHEEL SUSPENSION — Unique bearing arrangement places fan wheel center of gravity between the bearings provided, more rigid wheel suspension system . . . bearing well also adds rigidity.
- NO INLET OBSTRUCTIONS — Air stream is free of all braces, cross members and other obstructions which produce turbulence and noise.
- EASY ACCESS FOR SERVICING AND LUBRICATING — Bearings are accessible for easy lubricating. Bearings designed for belt drive application; totally enclosed designed for long life . . . motor (ball bearing motor and explosion proof also available).

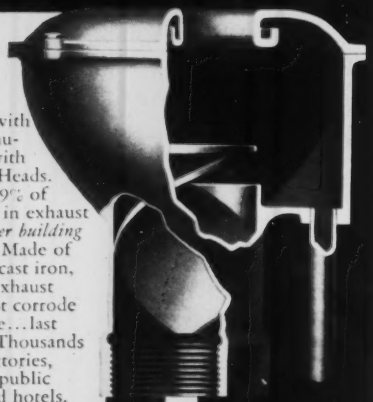
Write for new catalog, complete details and specifications.

GREENHECK FAN & VENTILATOR CORP.

SCHOFIELD • WISCONSIN

Swartwout EXHAUST HEADS slash building maintenance cost

Prevent the ravages of water and oil in exhaust steam during warm weather...do away with ice and grime accumulations in winter—with Swartwout Exhaust Heads. They remove over 99% of moisture and oil in exhaust steam—*for lower building maintenance.* Made of long-lasting cast iron, Swartwout Exhaust Heads do not corrode or deteriorate...last indefinitely. Thousands in use on factories, institutions, public buildings and hotels. Many still in use even after *50 years continuous service.*



Cutaway section shows exclusive helico-centrifugal principle that prevents back pressure. Swartwout Exhaust Heads blend in with modern or classic architecture, actually enhance building appearance.

Available from your industrial distributor or from The Swartwout Company. For exhaust pipes from 1 to 30" in diameter. Write for free Bulletin S-16-C.

The Swartwout Company

18511 EUCLID AVE. • CLEVELAND 12, OHIO

MEETINGS & CONVENTIONS

Continued

neering Show. Convention Hall, Philadelphia, Pa. For information contact: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

FEB. 1-4—2nd Southwest Heating and Air Conditioning Exposition. Dallas. Under auspices of the American Society of Heating, Refrigerating & Air-Conditioning Engineers, in conjunction with the newly merged society's semi-annual meeting also in Dallas. Meetings to be held in the Baker and Adolphus Hotels; exposition to be held ir Memorial Auditorium. For information contact: International Exposition Co., 480 Lexington Ave., New York 17. ASHRAE headquarters: 62 Worth St., New York 13.

APRIL 25-29—American Welding Society, annual meeting and exposition. Los Angeles. Information: American Welding Society, 33 W. 39th St., New York.

APRIL 27-30—Western Air Conditioning, Heating, Ventilating and Refrigeration Exhibit and Conference. Shrine Exposition Hall, Los Angeles. Information: Western Air Conditioning Industries Association, 3443 S. Hill St., Los Angeles 7. ±

J-E TYPE 701 3-WAY SOLENOID VALVE

for flow control of hot or chilled water with fan-coil units

This New addition to the J-E Line provides–

- Economical temperature control.
- Separable solder flange for easy installation.
- One size for ½ to 10 gpm for simple selection

Write for information bulletin today.

Controls Division
JACKES-EVANS MANUFACTURING CO.
4427 Geraldine Ave., St. Louis 15, Mo.

Exceptional

ENGINEERING OPPORTUNITY

With One of The Nation's Leading Growth Companies

American-Marietta

A diversified company, American-Marietta's 45 years of consistent, rapid growth and uninterrupted profitability are based on progressive management, a continuous research and development program, and growth products in many fields: adhesives and resins, cement, lime and refractories, construction products, paints and finishes, printing inks, sealants, metallurgy, and environmental and control equipment. Three-quarters of our management group is technically trained.

An excellent position with our Central Engineering group in Chicago is now available for an experienced graduate engineer interested in long-range career opportunities, a variety of creative, challenging assignments, and complete responsibility for project development:

MECHANICAL ENGINEER, experienced in design, estimating, supervision of drawings and preparation of specifications for industrial processing plants, equipment and facilities.

This position provides an attractive starting salary with liberal merit increases based on ability and initiative. A full program of benefits is available, including a company-sponsored educational program.

All replies confidential. Send resume to:

J. R. Lytle
American-Marietta Company
101 East Ontario Street
Chicago 11, Illinois

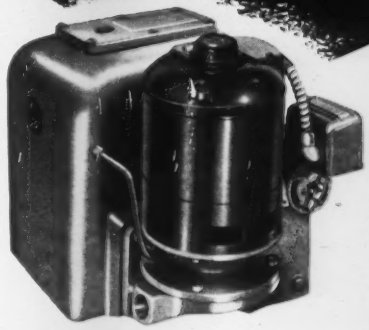
Reduce costs up to 75% by bending..

TAL BENDERS by HEIN-WERNER MAKE SMOOTH, UNIFORM BENDS WITHOUT DISTORTION!

Take a tip from other contractors – choose a Hein-Werner Tal Bender to save up to 75% of time and labor costs. Bending is *the practical* way to reduce cost of cutting and threading or welding fittings. And, Hein-Werner Tal Benders are simple to operate and *easy to handle* – one frame and one setting bends material cold without shifting or resetting. You choose the right set or combination that's best for you to bend pipe and conduit in diameters from ⅜" to 8". Learn how you can slash material and assembling costs by bending – write for catalog No. 35 that shows the many exclusive features offered by Hein-Werner, or see your plumbing and heating wholesaler for full information.

Hein-Werner CORPORATION
WAUKESHA, WISCONSIN

IT'S NEW! IT'S TOPS!
it's the Sterlco® 4223-E
LOW PRESSURE
CONDENSATE PUMP



- SURPRISING VERSATILITY
- UNUSUAL CAPACITY
- TREMENDOUS PERFORMANCE
- ECONOMICAL PRICE

- **DESIGNED SPECIFICALLY FOR SMALL INSTALLATIONS . . .** yet adequate for jobs up to 3000 sq. ft. EDR.
- **ALLOWS ACCURATE ADJUSTMENT . . .** Float switch travel can be adjusted for a draw of from .7 to 3 gals. per pumping cycle for close adjustment to boiler requirements.
- **SMALLER IN SIZE, YET BIGGER IN USABLE VOLUME . . .** a truly believe-it-or-not design. Although the 5 gal. cast iron tank is one of the smallest, it has greater "draw" or usable volume than many pumps with larger tanks.
- **LOTS OF EXTRA CAPACITY FOR EMERGENCIES . . .** Equipped with the same pump and motor used for the larger capacity ¼ h.p. Sterlco pumps.
- **TAKES LESS SPACE THAN ANY OTHER . . .** Occupies only 1.6 sq. ft. of floor space. Fits easily into almost any small corner because of rectangular shape and convenient location of motor and switch at front of unit.
- **EXCEPTIONALLY QUIET, RUGGED, DEPENDABLE . . .** Includes the same high quality features found in Sterlco's heavy duty pumps.

USE THE RIGHT PUMP FOR THE JOB!

The addition of the No. 4223-E makes the Sterlco 4100-4200 Series Condensation Pumps one of the most complete lines of low pressure pumps on the market.

Write now for complete information.

Sterlco Products Distributed Through Leading Heating and Plumbing Wholesalers. Representatives in all principal cities.

STERLING, INC.
5202 W. Clinton Ave., Milwaukee 18, Wisconsin

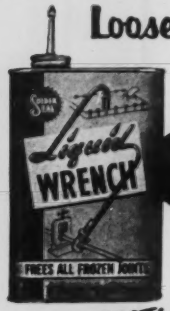
CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS

Loosens Rust and Corrosion

Quickly frees 'frozen' parts!



LIQUID WRENCH

The Super-penetrating Rust Solvent

powerful blend of fast-acting solvents that literally "melts the rust away"

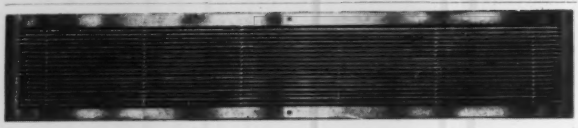
Works FAST!

At your wholesaler!

SOLDER SEAL

2198

RADIATOR SPECIALTY CO., Charlotte, N. C.



DIAMOND FABRICATED GRILLES
FOR MODERN PUBLIC BUILDINGS

Heating Engineers asked for a stronger, more durable grille — in harmony with the modern trend toward maintenance-free construction through greater use of Aluminum and Steel. Here's our answer: a Custom-Built Heavy-Duty Bar-Type Grille that provides long-needed protection against the trouble and expense so often caused by replacement of ordinary light-gauge grilles.
Available in any desired size or shape — All Steel or All Aluminum — for straight or deflected air flow. Bulletin 43 gives complete information. Write for free copy.

DIAMOND MFG. CO. WYOMING (Wilkes-Barre Area) PA.

Manufacturers, also, of DIAMONTEX, the Perforated Metal Lay-in Panel for modern acoustical ceilings. Ask for Bulletin 47

. . . enough JEWEL clamps cut erection costs

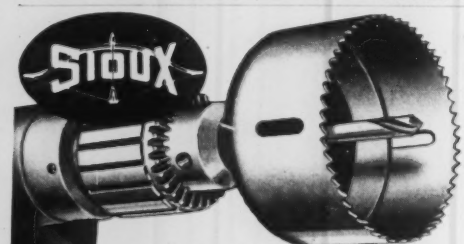
PIPE WELDING CLAMPS

Jewel Pipe Clamps are lightweight — rigidly constructed — resist strain, heat and abuse.

FOR WELDING
PIPE • FLANGES •
ELBOWS • ANGLES
—also PIPE MARKERS

Jewel Clamps align pipe perfectly, and hold it there until it is welded. Two sizes, ½" to 8"; 8" to 16". Write for details.

JEWEL
MANUFACTURING CO.
1841 University Ave.
St. Paul 4, Minnesota.



DRILLS and HOLE SAWS

When it's a *SIOUX* Certified Power Electric Drill, you know what it will do. Horsepower and torque for each SIOUX drill are rated, stated and certified.

SIOUX High-Speed, Steel-teeth Hole Saws will cut holes from ⅝" to 6" in diameter in any free machining material to a depth of 1⅛". Call your nearest SIOUX distributor or write . . .

ALBERTSON & CO., INC.
SIOUX CITY, IOWA, U.S.A.

NEW BOOKS & REPORTS...

COMMERCIAL STANDARD, WARM AIR FURNACES EQUIPPED WITH PRESSURE-ATOMIZING OR ROTARY TYPE BURNERS—(Revision TS-5453) H. A. Bonnet, Commodity Standards Div., U. S. Dept. of Commerce, Washington 25, D.C.

PERFORMANCE OF COMMERCIAL GAS CLEANING EQUIPMENT—American Gas Association 420 Lexington Ave., New York 17. $2.00.

FACTS ABOUT HEATING PLANT ACCIDENTS AND OIL—National Fueloil Council Inc., 424 Madison Ave., New York 17.

LEAKAGE FROM UNDERGROUND FLAMMABLE LIQUID TANKS—(NFPA No. 329M) National Fire Protection Association, 60 Batterymarch St., Boston 10. 50 cents.

NOISE IN BUILDINGS—150 pp. Building Research Institute, National Academy of Sciences-National Research Council, 2101 Constitution Ave., Washington 25, D.C. $5.00. ±

Obituaries

Otho M. Ard

OTHO M. ARD, former branch manager of National-U.S. Radiator Corporation's Cincinnati branch, died July 28.

Mr. Ard joined the corporation in 1925 as a salesman in the Cincinnati branch and served as branch manager for 19 years.

Theodore R. Roberts

THEODORE R. ROBERTS, 61, Ohio Brass Co. valve department manager, passed away on August 2 in Mansfield, Ohio after a lingering illness.

He had been with Ohio Brass for more than 43 years, being appointed assistant valve department manager in 1925 and manager in 1944.

Fred George Miller

FRED GEORGE MILLER, 79, died on July 30 in Cleveland.

Mr. Miller has been a member of the City of Cleveland Codes Committee, the national Society of Sanitary Engineers, and was a charter member and Treasurer of the National Supply Association of America.

. . . find what you need quickly
and economically through . . .

CLASSIFIED ADVERTISING

Rates for classified advertising are 15 cents for each word including heading and address. One inch $7.00. Count nine words for keyed address. Minimum $2.50 for each insertion. Cash must accompany order. Closing date 10th of month preceding issue.

SITUATIONS WANTED

Sales Engineer — Southern states, Florida and Texas — engineering education — commission plus part travel expenses. Considerable experience in process equipment. Coverage, consulting engineers, architects, contractors and wholesalers. Address Key 1427A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

SITUATIONS OPEN

MECHANICAL ENGINEERS

With 3 or more years experience in mechanical design for buildings, including heating, air conditioning, plumbing, etc. Permanent employment with well-established midwestern consulting engineering firm. Write Key 1423A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill., giving personal resume and required salary.

SALES ENGINEER

Opportunity for growth with New England manufacturer of centrifugal pumps, heat exchangers and allied equipment for heating and cooling applications. Essential to have a record of sales experience and accomplishment in selling specification equipment to wholesalers, contractors, engineers and architects preferably in the heating and cooling field. Mechanical engineering or other technical degree or equivalent experience required. Must be willing to relocate and travel. Send resume, salary history and requirements. All replies will be kept confidential. Address Key 1421A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

SALES ENGINEER

Established Chicago manufacturing company will receive applications from young man for opening in its New York office. Must be familiar with refrigeration, air conditioning, and related heat exchange applications. Prefer New York City resident, and one familiar with the New York territory, to operate out of the company's office in Long Island City. State age, educational background, sales experience, and marital status, including minimum salary requirements. Good opportunity for right party. Address Key 1428A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

WANTED — Experienced plumbing-heating Estimator-Engineer. Engineering degree preferred, but not required. Positions open in Anderson, Indiana and Dayton, Ohio. Write TIBCO, Box 27, Anderson, Indiana.

AGENTS WANTED

MANUFACTURER'S AGENTS

An established manufacturer with 25 years experience, producing ventilating equipment is looking for manufacturer's agents in many sections of the country to sell their new line of industrial fans.

The products include axial flow and tubeaxial fans, both direct and belt driven, and power roof ventilators. Please reply Key 1361A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

MANUFACTURERS AGENT WANTED — Manufacturer with low cost Stamped Steel Pulleys "A" — "O" section line also V-Belts. Desires representative to call on OEM's of heating, air conditioning, fans, appliances, small tractors and lawn maintenance equipment. Territory — Kansas and Missouri. A few other territories open. Reply Key 1426A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

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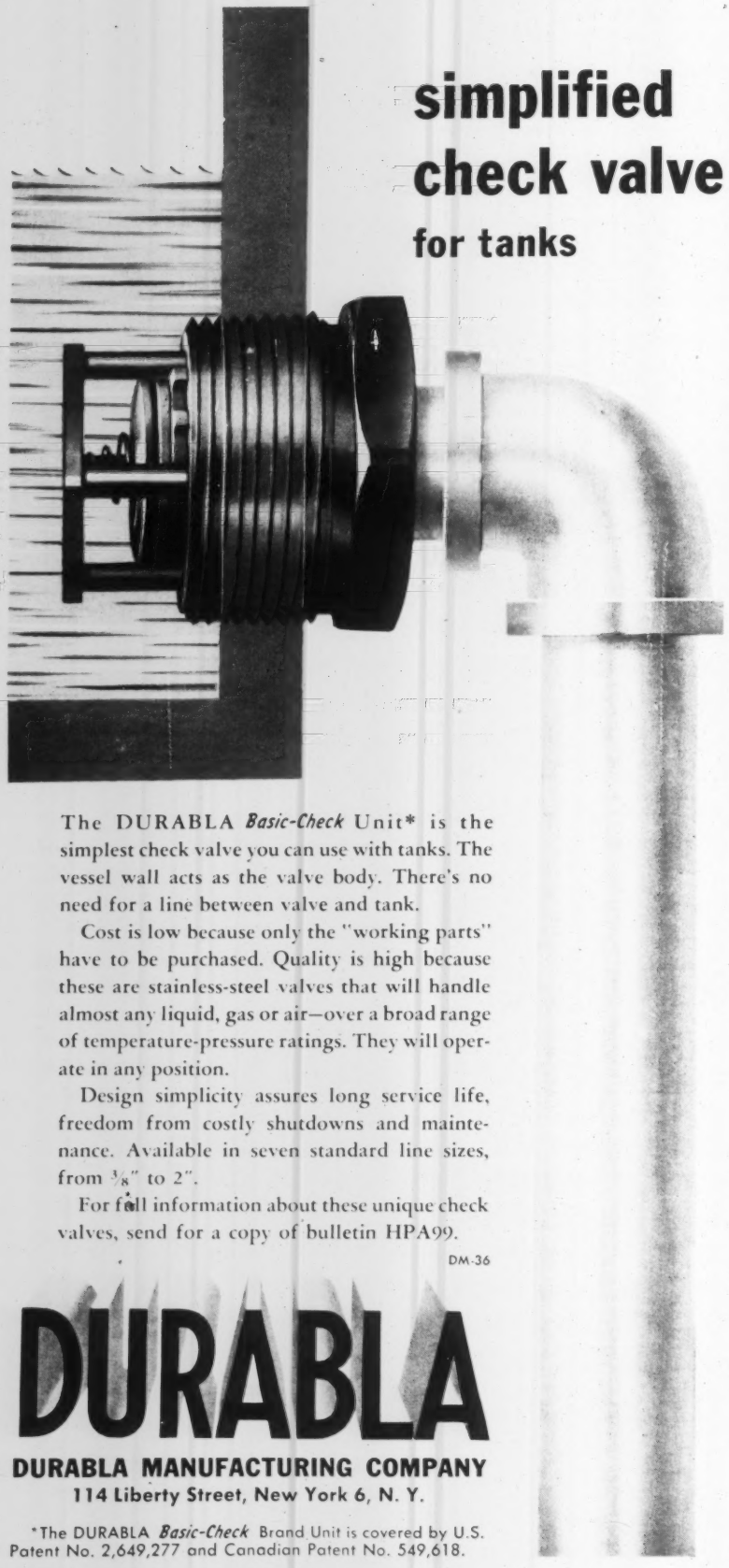

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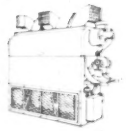

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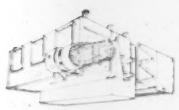

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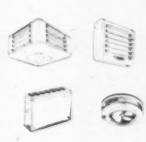

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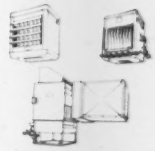

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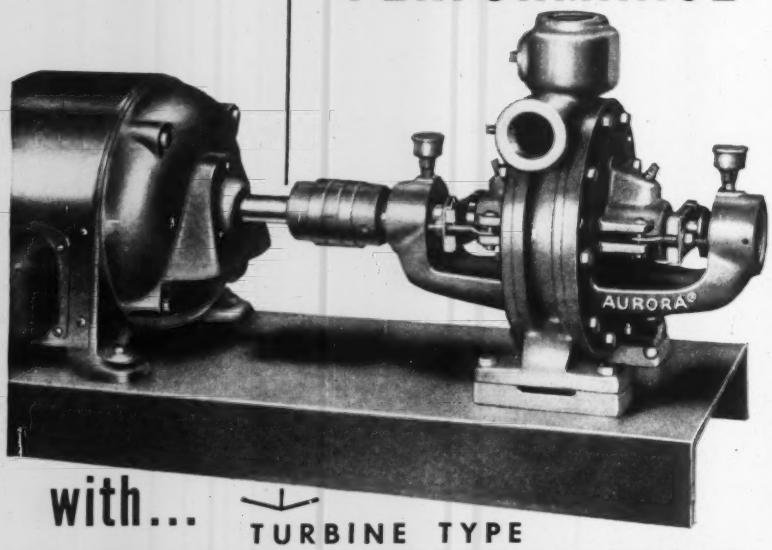

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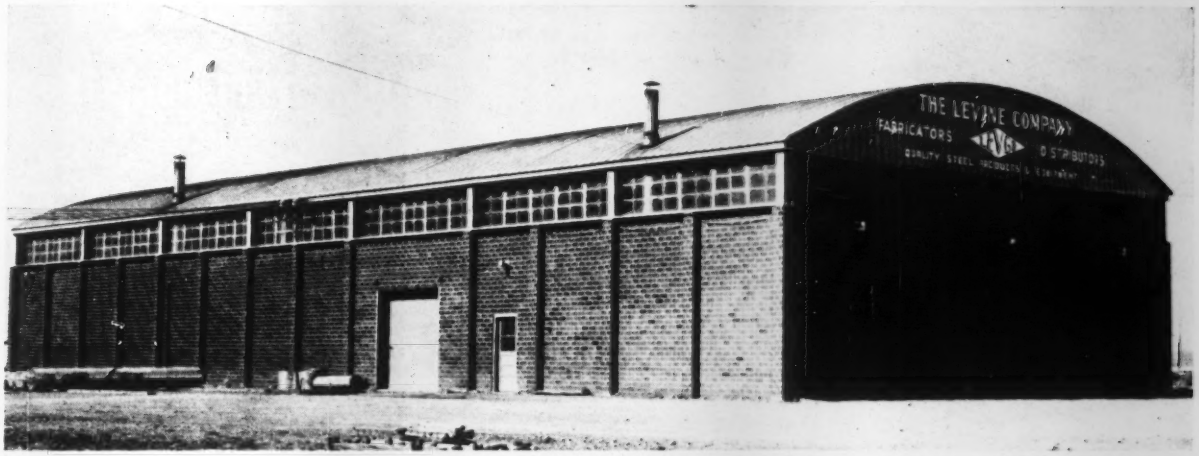

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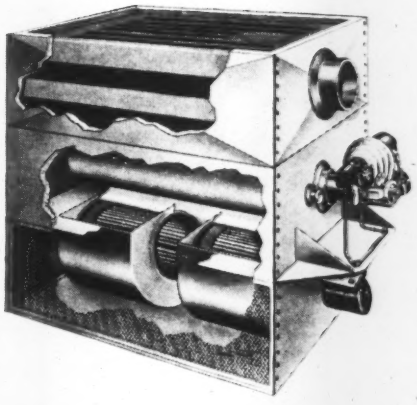

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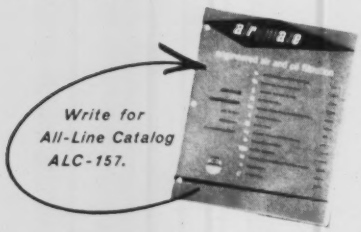

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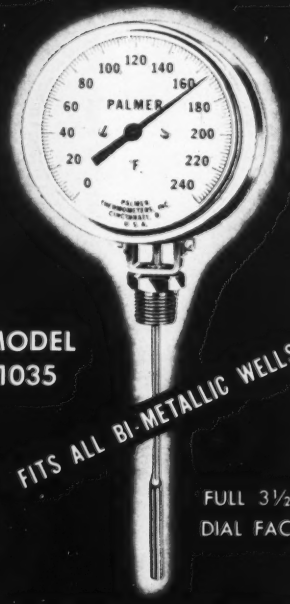

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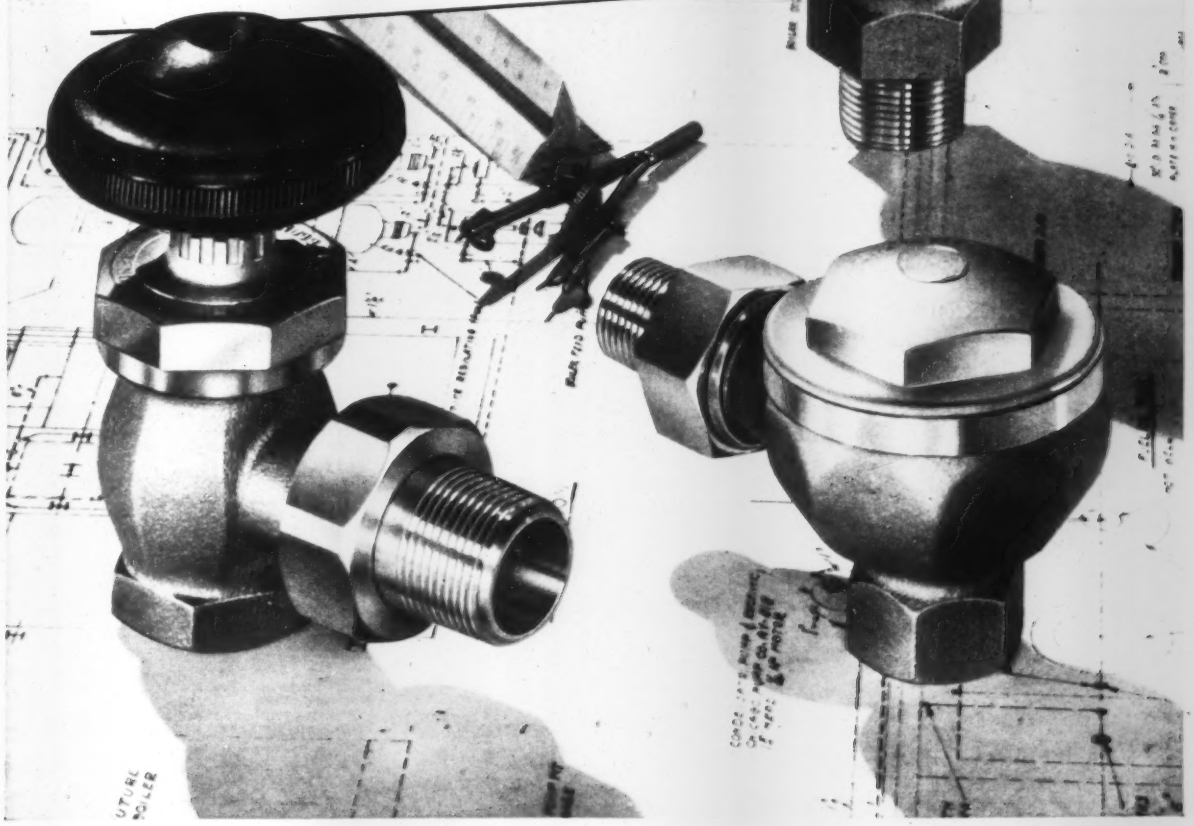

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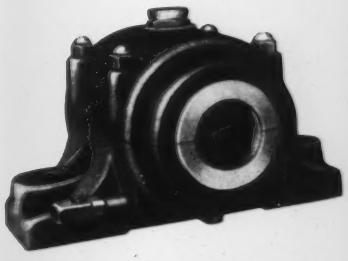

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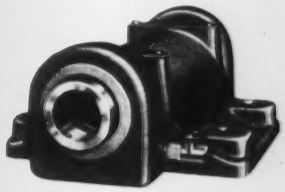

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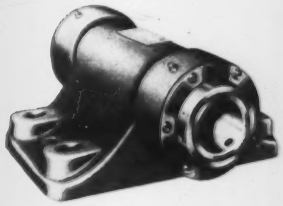

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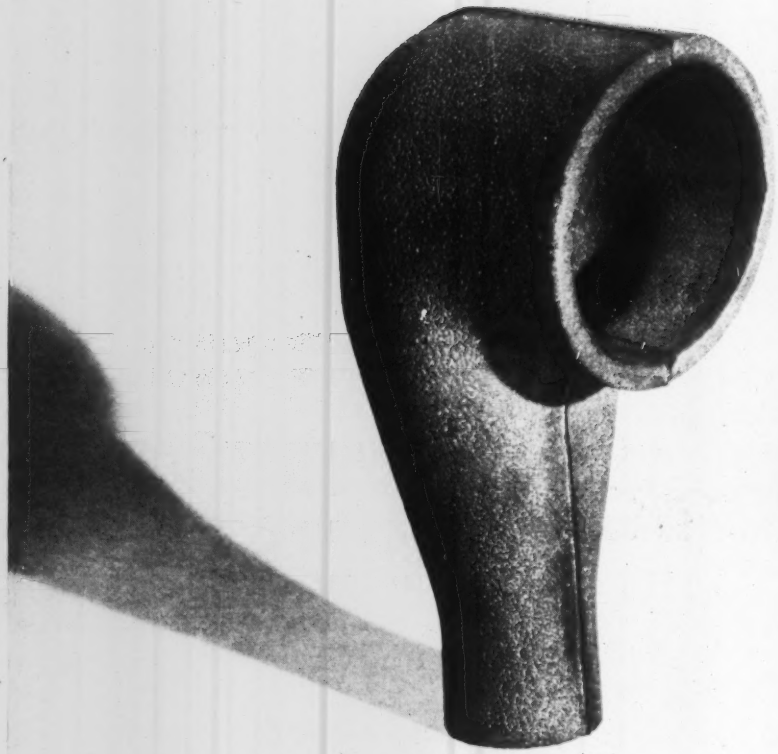

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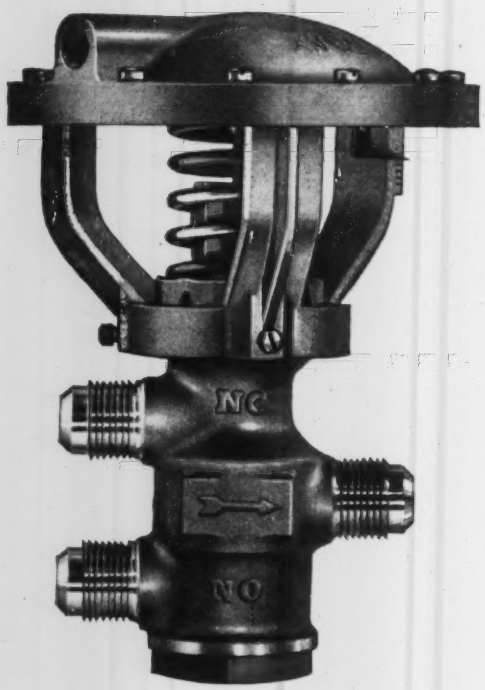
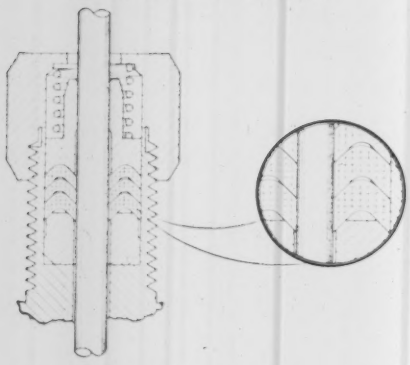
FOR SMALL ROOM AIR CONDITIONING UNITS



V-154 Three-Way Mixing Valve
(Inner Valve — Flat Disc)



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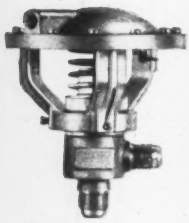
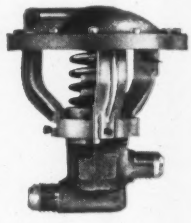
- Special V-ring, self-sealing packing:
  - **a.** Utilizes the force of the water pressure to effect a positive seal. Always has the right packing gland pressure to prevent leakage.
  - **b.** Requires no initial manual adjustment.
  - **c.** Automatically compensates for wear, eliminates need for servicing.
  - **d.** Minimizes friction because sealing force is proportional to fluid pressure.
  - **e.** Automatically compensates for changes in water temperature.
- Long-wearing, resilient molded rubber diaphragm. Diaphragm top can be removed without disturbing balance of assembly.
- Adjustable spring range permits synchronization of operation of valves in several units when controlled by a single thermostat. Special spring construction eliminates spring set and fatigue.
- ½" O.D. S.A.E. flare connections fit tubing employed with unit. No special pipe to tubing adapters required.

Full details are contained in Bulletin Nos. V-152, V-154, and V-164. Write Johnson Service Company, Milwaukee 1, Wisconsin.



V-152
ANGLE VALVE



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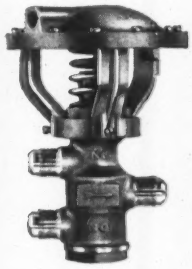

V-164
THREE-WAY MIXING VALVE
(Inner Valve-Modulating Plug)

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